IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF NORTH CAROLINA
NORTHERN DIVISION

NO. 2:15-cv-00042-BO

RED WOLF COALITION, DEFENDERS OF WILDLIFE, AND ANIMAL WELFARE INSTITUTE,	)
Plaintiffs,	)
v.	)
THE UNITED STATES FISH AND WILDLIFE SERVICE; ; JIM KURTH, in his official capacity as Acting Director of the United States Fish and Wildlife Service; MIKE OETKER, in his official capacity as Acting Regional Director of the United States Fish and Wildlife Service Southeast Region.[1]	)
Defendants.	)

APPENDIX TO
PLAINTIFFS' STATEMENT OF UNCONTESTED FACTS,
MOTION FOR SUMMARY JUDGMENT,
AND MEMORANDUM IN SUPPORT

Part I of II

[1] Pursuant to Federal Rule of Civil Procedure 25(d), Jim Kurth, Acting Director of the U.S. Fish and Wildlife Service, is substituted for Daniel M. Ashe, former Director, and Mike Oetker, Acting Regional Director of the U.S. Fish and Wildlife Service Southeast Region, is substituted for Cynthia Dohner, former Regional Director.

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RED WOLF COALITION, DEFENDERS OF WILDLIFE, AND ANIMAL WELFARE INSTITUTE, PLAINTIFFS, V. THE UNITED STATES FISH AND WILDLIFE SERVICE, DAN ASHE, IN HIS OFFICIAL CAPACITY AS THE DIRECTOR OF THE UNITED STATES FISH AND WILDLIFE SERVICE; CYNTHIA K. DOHNER, IN HER OFFICIAL CAPACITY AS REGIONAL DIRECTOR OF THE UNITED STATES FISH AND WILDLIFE SERVICE SOUTHEAST REGION, DEFENDANTS.	)	NO. 2:15-CV-42-BO

DEPOSITION OF REBECCA BARTEL HARRISON, Ph.D.

FRIDAY, JUNE 2, 2017

GOVERNOR'S BOARD ROOM

RALEIGH MARRIOTT CITY CENTER

500 FAYETTEVILLE STREET

RALEIGH, NORTH CAROLINA

9:01 A.M.

VOLUME 1

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T A B L E   O F   C O N T E N T S

EXHIBITS (cont'd)

We did not have -- in my tenure there, we didn't have comparable funding levels for research projects, although we had a few.

Q. Did you ever identify areas that needed researched during that position?

A. I made recommendations.

Q. Do you remember what those recommendations were?

A. One of them was the Population Viability Analysis.

Q. And when you say "the Population Viability Analysis," what does that mean?

A. The more recent Population Viability Analysis. There were several before my -- before my involvement in the program. The one that I am referring to was conducted by partners at Lincoln Park Zoo in Chicago with facilitation by the SSP Coordinator.

Q. Okay. Any other recommendations that you made?

A. I am trying to recall. We just didn't have a lot of money for those types of projects, sadly.

Q. How long were you the Assistant Red Wolf Recovery Coordinator?

A. I left the position in July 2016.

Q. David Rabon was your supervisor when you

started, correct?

A. Yes.

Q. Did that change?

A. Yes.

Q. When did that change?

A. September of 2014.

Q. What happened in September 2014?

A. David was offered a directed reassignment.

Q. What does that mean?

A. I am not -- I am not entirely sure what that means administratively. It is my understanding that, based on agency need, you could get assigned to a different program. And that may be a different station physically.

Q. So he accepted that directed reassignment?

MR. HESSLER: Objection. Calls for speculation.

THE WITNESS: He did not.

BY MS. McGEE:

Q. Thank you. And when David Rabon was no longer your supervisor, who became your supervisor?

A. Initially it was Art Beyer. And then when Art left the program it was Pete Benjamin.

Q. And you said "when Art left the program." When did Art leave the program?

A. Approximately June 2015.
Q. So approximately from September 2014 until June 2015, Art was your supervisor -- your direct supervisor?
MR. HESSLER: Objection. There is no question. Asked and answered.
THE WITNESS: Art was my supervisor approximately September 2014 to June 2015.
BY MS. McGEE:
Q. And who was Art's supervisor during that time?
A. Pete Benjamin.
Q. And then is it correct that Pete Benjamin was your supervisor -- direct supervisor, excuse me, from approximately June 2015 until July 2016?
A. Yes.
Q. Do you know who Pete Benjamin's direct supervisor is?
A. Yes.
Q. Who is it?
A. Michele Eversen.
Q. And do you know who Michele Eversen's direct supervisor is?
A. I am not certain. I would assume it is Leo, but I don't know the organization of that upper level supervision.

Q. And when David Rabon was with the program, who was his direct supervisor?

A. When I started with the program, his direct supervisor was Mike Bryant.

Q. And who is Mike Bryant?

A. Mike Bryant is the project leader of the refuge complex at Alligator River.

Q. And did David Rabon's direct supervisor change at some point while you were working with the Red Wolf Recovery Program?

A. Yes.

Q. Who did David Rabon's direct supervisor become?

A. Pete Benjamin.

Q. Do when that change took place?

A. We were realigned under Ecological Services approximately December 2013.

Q. Do you know why the program was realigned under Ecological Services?

A. That was a decision above my supervision.

Q. Sure. Was any reason communicated to you for the change?

MR. HESSLER: Objection. Asked and answered. Calls for speculation.

THE WITNESS: I don't know.

BY MS. McGEE:

Q. That is fine. While you worked with the Red Wolf Recovery Program, was there any Outreach Coordinator?

MR. HESSLER: Objection. Vague as to outreach coordinator.

THE WITNESS: Do you mean someone with that title?

BY MS. McGEE:

Q. Yes.

A. No.

Q. Do you know if there ever was a position titled Outreach Coordinator with the Red Wolf Recovery Program?

A. To my knowledge, there was.

Q. Do you know what happened to that position?

A. I would have to speculate. But I think there was someone in that role initially. And then I think when David -- I don't know that she was under David. I think she was under the previous Recovery Coordinator. And when she had left that position, I am not sure what happened with the vacancy, but I think the positions were sort of reorganized.

And outreach was probably one of the many duties as Assistant Recovery Coordinator or Recovery

Q. Okay. Did anyone else leave the Red Wolf Recovery Program during your time with the program?

A. As I mentioned earlier, Art transferred to refuges, and Chris Lucash died.

Q. Did anyone fill Art's position when he transferred?

A. No.

Q. And did anyone fill Chris' position?

A. No.

MR. HESSLER: Objection. Doesn't have any temporal limitation.

THE WITNESS: There have been other people in the program, but I don't know that it was a one-to-one position replacement.

BY MS. McGEE:

Q. Sure. I understand. Did your responsibilities or work duties under the Red Wolf Recovery Program change compared from when you started until when you ended?

MR. HESSLER: Objection. Vague.

THE WITNESS: What kind of responsibilities?

BY MS. McGEE:

Q. So did your responsibilities regarding looking at and maintaining data change in any way during your

sites to see if it could potentially be restored for -- or kind of supplemented to create some pollinator habitat.

Q. What did you think? Could it be supplemented to create some habitat?

A. I think I am probably biased. But I think habitat can always be potentially supplemented to create pollinator habitat. You can do it in a pot. It is pretty easy. But we just visited with partners and made some recommendations. Honestly, I don't know how -- if they were implemented.

Q. Sure. And while you were with the Red Wolf Recovery Program, where was your main office located?

A. Manteo.

Q. Manteo. What was that work address?

A. 100 Conservation Lane.

Q. The same work address that you currently have?

A. Yes.

Q. Okay. When you left the Red Wolf Recovery Program in 2016, where did you go?

A. I took a position with Refuges.

Q. What is that position?

A. Supervisory Refuge Biologist.

Q. And that is your current position, is that correct?

we are doing a survey with partners or if I am needed specifically in the field or can help.

Q. Do you still coordinate with the Red Wolf Recovery Program at all?

A. Coordinate in what way?

Q. Do you communicate with any of the Red Wolf Recovery Program staff?

A. Yes.

Q. Do you communicate with any of the Red Wolf Recovery Program staff about the Red Wolf Recovery Program?

A. Yes.

Q. Do you -- do any of your work responsibilities include work with red wolves currently?

A. In my current role, my work with Red Wolves is probably more limited to activities that happen on the Refuges.

Q. What sort of activities would that include?

A. That may include things like issues with Sandy Ridge, since Sandy Ridge in on the Refuge. Any translocations or anything that happens with any of the existing animals on the Refuges.

Q. Do you have your own office the Manteo office?

A. My -- my ---

Q. Do you have your own -- like your own ---

A. Thank you.

(Witness peruses document.)

Is this redacted or ---

Q. I don't know.

A. It may have been a video.

Q. That is possible. That would make more ---

A. (Interposing) I think it was a video. I can't remember specifically, but ---

Q. Thank you. Do you know what sort of video it might have been?

A. I think it is a video produced by the Zoo Society at Point Defiance.

Q. Okay. Thank you.

A. There are some other video links in here. That is what I think it is.

Q. So as you have been looking through this, you have probably noticed that there are Bates numbers at the bottom right-hand corner of the pages. I would like to refer you to Bates Number USFWS-0013101. It is a slide entitled "Why restore red wolves?" What does the bullet point under scientific values, "successes of the program, model," mean?

A. It could be a model system for those types of reintroduced species.

Q. Is that what "success of program" refers to?

A. Yes.
Q. So what is the scientific value of restoring red wolves?
MR. HESSLER: Objection. Vague.
THE WITNESS: What do you mean?
BY MS. McGEE:
Q. So the slide we are looking at is entitled "Why restore red wolves?" And it appears to be a list of reasons why to restore red wolves.
A. Yes.
Q. What are the scientific values of restoring red wolves?
A. To study that type of carnivore system and to inform potential other systems.
Q. And what are the ecological values of restoring red wolves?
A. That refers to sort of the role of red wolves in the ecosystem. Their role as predator, how they can affect natural systems around them.
Q. What do you mean by "their role as predator"?
A. You know, how they control or impact prey species, sort of ecosystem resilience when all the parts of a particular system are present.
Q. So red wolves are part of that ecosystem and influence that ecosystem you refer to?

Q. So on the next page, this slide is entitled "Recovery Success Pup Fostering." How is pup fostering a recovery success for the red wolf?

MR. HESSLER: Objection. Vague. No time limitation.

THE WITNESS: I think recovery success for pup fostering could mean a lot of things. What I am referring to here is that -- the biological components of that: that pups were reintroduced into the wild from captivity and a portion of them survived.

BY MS. McGEE:

Q. And that was a recovery success?

MR. HESSLER: Objection. Asked and answered.

BY MS. McGEE:

Q. On the next slide, how was placeholders a recovery success?

MR. HESSLER: Objection. Vague. No time limitation.

BY MS. McGEE:

Q. On this slide, you refer to adaptive management, 1999 through 2014. How was that a recovery success for the red wolf?

MR. HESSLER: Objection. Calls for speculation.

biological components of that particular tool here.

BY MS. McGEE:

Q. So it was biologically successful for the red wolf?

MR. HESSLER: Objection. Asked and answered.

THE WITNESS: I think these bullet points are what I was trying to communicate by "success."

BY MS. McGEE:

Q. On the next slide, how are reproductive techniques a recovery success for red wolves?

A. The specific reproductive technique that I was kind of referring to is a group of techniques here listed, like embryo banking and cryogenetic preservation of sperm and, basically, IBF for canids. And that was a tool that was developed in this program as part of the recovery objectives.

Q. And on the next slide, what do you mean by model system as a recovery success?

MR. HESSLER: Objection. Vague. Calls for speculation.

THE WITNESS: I believe what I meant in model system in this case is that it -- as the bullet indicates, that it was one of the earliest wild carnivore reintroduction programs.

BY MS. McGEE:

Q. And you say it was the first successful wild carnivore reintroduction. What do you mean by successful?

A. That we had reproduction in the wild, and that animals established territories and displayed normal wolf behaviors.

Q. And can you refer to page number 0013110? Did you create this chart?

A. Yes.

Q. What data did you use to create this chart?

A. A couple of sources of data from the wild population.

Q. What does this chart depict?

A. It shows generic population trends over time from the beginning of the program until roughly 2012-13.

Q. What do you mean by generic?

A. I mean a general trend of the population.

Q. Just making sure I am not missing a ---

A. I am sorry.

Q. No. That is fine. And when did the wild red wolf population peak?

MR. HESSLER: Objection. Vague. Calls for speculation.

BY MS. McGEE:

THE WITNESS: Do you mean the number of wolf/wolf pairs?

BY MS. McGEE:

Q. YES.

A. Okay. Before my time in the program.

Q. Do you know approximately when that would have been?

MR. HESSLER: Objection. Asked and answered. And calls for speculation.

THE WITNESS: Before my time in the program.

BY MS. McGEE:

Q. Do you know how many breeding pairs of wild red wolves there were when you started with the program?

A. I don't recall the exact number in 2012. In my recollection, I think the peak number was relatively higher in -- you know, in earlier years, relative to 2012.

Q. Do you know, did the number of breeding pairs of red wolves in the wild decrease during your time as Assistant Recovery Coordinator?

A. Yes.

Q. Do you know by how much?

A. I don't remember what it started as in 2012, but I remember what it approximately was when I left.

Q. Which was what?

A. Based on the ability to detect breeding pairs, which is an issue, it is somewhere between four and six.

Q. And why was it an issue to detect breeding pairs when you left the Recovery Program?

A. Accessibility to different properties in the recovery area.

Q. Do you know how many of those breeding pairs had radio collars?

A. When I left?

Q. Yes.

A. All of them. I am not including anything that wouldn't be collared, because I couldn't speculate for that.

Q. Do you know if they were collared with radio collars or GPS collars?

A. When you say radio collars, do you mean VHF collars?

Q. Yes.

A. Okay. At the time that I left, at least one member of the breeding pair had a VHF collar on and was being actively monitored.

Q. And that was how you were able to determine the number of breeding pairs?

A. Yes.

Q. And I am giving you again Exhibit 2, and have it open to that chart that we were discussing previously. Is the population trend line depicted in that chart indicative of a growing population of red wolves?

MR. HESSLER: Objection. Vague, and calls for speculation.

THE WITNESS: Do you mean for the whole time series?

BY MS. McGEE:

Q. Yes.

A. For the whole time series, in the context of the 30 years, there is a pattern that indicates growth over time.

Q. When was the last pup fostering event in the Red Wolf Recovery Program, to the best of your knowledge?

A. Do you mean captive to wild?

Q. Yes.

A. 2014.

Q. 2014. Why were there no more captive to wild pup foster events after that time?

MR. HESSLER: Objection. Calls for speculation, and vague as to captive pup fostering.

THE WITNESS: Do you mean biologically, or what are you referring to?

BY MS. McGEE:

Q. Was there a biological reason for no more pup fostering?

A. Not to my knowledge.

Q. Did you make a decision to no longer have captive to wild pup foster events?

A. No.

Q. Did someone else make a decision to no longer do captive to wild pup foster events?

MR. HESSLER: Objection. Calls for speculation.

THE WITNESS: Yes.

BY MS. McGEE:

Q. Do you know who made that decision?

MR. HESSLER: Objection. Calls for speculation, and vague.

THE WITNESS: There is a press release in June 2015 from our Regional Director that indicates that we were not going to be releasing animals into the wild and using any of the mechanisms, including pup fostering.

BY MS. McGEE:

Q. So did the Regional Director make that decision to end pup fostering events from captive to wild?

MR. HESSLER: Objection. Calls for speculation.

THE WITNESS: I don't know who made that decision.

BY MS. McGEE:

Q. Someone senior to you, is that fair?

A. Yes.

Q. And when was the last time any captive wolf -- sorry, let me rephrase that. To the best of your knowledge, when was the last time a wolf from the captive population, irrespective of whether they were a pup or not, was released into the wild in the Red Wolf Recovery Program?

MR. HESSLER: Objection. Vague.

THE WITNESS: Do you mean pup fostering?

BY MS. McGEE:

Q. As in non-pup fostering event.

A. As a juvenile or an adult?

Q. Yes.

A. Before I started there.

Q. Okay. So during your time with the Red Wolf Recovery Program, all releases from the captive population to the wild population of red wolves occurred through captive to wild pup fostering events?

A. Correct.

Q. To the best of your knowledge, at what point was the last coyote sterilization event within the Red

Wolf Recovery Program?

A. I don't recall the specific date. I believe we were sterilizing coyotes up through 2014. There may have been some in the winter of 2015. I don't recall. And when I mean winter, I mean January, February of the calendar year 2015?

Q. Like the population year?

A. Yes.

Q. Why were no more coyote sterilizations conducted after that time?

MR. HESSLER: Objection. Calls for speculation.

BY MS. McGEE:

Q. Was there a biological reason to stop conducting coyote sterilizations at that time?

A. Not to my knowledge.

Q. Was a decision made to stop conducting coyote sterilizations at that time?

A. Yes.

Q. Do you know who made that decision?

MR. HESSLER: Objection. Calls for speculation.

THE WITNESS: I do not.

BY MS. McGEE:

Q. Was it someone senior to you?

MR. HESSLER: Objection. Calls for speculation, and asked and answered.

THE WITNESS: Yes.

BY MS. McGEE:

Q. Thank you. To the best of your knowledge, are any of the components of the Adaptive Management Plan, other than coyote sterilizations, still taking place today?

MR. HESSLER: Objection. Calls for speculation and vague.

THE WITNESS: What specific components of the Plan are you referring to?

BY MS. McGEE:

Q. As of the time when you left the program in 2016, was the Red Wolf Recovery Program staff still implementing the Red Wolf Adaptive Management Plan in any way?

MR. HESSLER: Objection. Vague as to Adaptive Management Plan.

THE WITNESS: Yes.

BY MS. McGEE:

Q. Can you tell me in what way?

MR. HESSLER: Objection. Vague.

THE WITNESS: As outlined on page eight, the monitoring and identification of individuals with

Q. And what are those issues that you referenced that are in these documents?

MR. HESSLER: Objection, vague as to "issues" and "documents." There is multiple documents here, and calls for speculation.

THE WITNESS: The -- several memos, the different subject lines, sort of the request to remove non-problem wolves, different take revisions, interpretation of the rules, those types of things.

BY MS. McGEE:

Q. Did the Red Wolf Recovery Program continue to receive requests in -- requests for removal of red wolves from private lands in 2015?

MR. HESSLER: Objection, calls for speculation, vague.

THE WITNESS: Request for removal in what way?

BY MS. McGEE:

Q. Did the Red Wolf Recovery Program receive requests from private landowners for removal of red wolves from their private lands in 2015?

A. Yes.

Q. Did the Red Wolf Recovery Program receive requests from private landowners for removal of red wolves from private lands in 2016?

A. Yes.

Q. To the best of your knowledge, did the Red Wolf Recovery Program receive requests from private landowners to remove red wolves from private lands in 2017?

A. I don't know, because I wasn't working with the program then.

Q. In 2015, do you know approximately how many requests for removal of red wolves from private lands the Red Wolf Recovery Program received?

MR. HESSLER: Objection, calls for speculation.

THE WITNESS: Relative to the requests received in 2014, it was less.

BY MS. McGEE:

Q. Do you know how many requests for removal of red wolves from private landowners the Red Wolf Recovery Program received in 2016?

MR. HESSLER: Objection, calls for speculation.

THE WITNESS: I don't know the exact number. Since 2014, we haven't received the same number of requests.

BY MS. McGEE:

Q. Did the Red Wolf Recovery Program receive more

requests for removal of red wolves from private lands in 2016 than in 2015?

MR. HESSLER: Objection, calls for speculation.

THE WITNESS: I don't recall specifically. To the best of my knowledge, it was similar levels.

BY MS. McGEE:

Q. What biological impacts would result from removing all wolves requested to be removed by private landowners?

MR. HESSLER: Objection, vague, calls for speculation.

THE WITNESS: There are multiple potential biological impacts by removing one wolf or more wolves from a particular piece of land. That is why they are handled on a case-by-case basis.

BY MS. McGEE:

Q. So if all requests for removal of red wolves resulted in the removal of the wolf in question, what would be the biological impact on the red wolf population in the wild in Eastern North Carolina?

MR. HESSLER: Objection, vague as to removal requests." Calls for speculation, and is asked and answered.

THE WITNESS: They are handled on a case-

by-case basis, so there could be different biological complexities based on how many animals it was and where on the landscape it was. There is other factors involved, whether we could even remove an animal.

THE WITNESS: This one just has an Exhibit number for Art. Does it need to have an Exhibit number for -- is that okay?

MS. McGEE: No, that is fine. Thank you for checking. Good eye.

(PLAINTIFFS EXHIBIT 70 WAS MARKED FOR IDENTIFICATION.)

BY MS. McGEE:

Q. All right. I am handing you what will be marked as Exhibit 70. That is Bates number 19899.

(Witness peruses document.)

Are you familiar with this document?

A. I haven't looked at it in awhile, but I recognize it as a correspondence I sent to Leo.

Q. What is this e-mail about?

MR. HESSLER: Objection, vague.

THE WITNESS: I received an information request from Leo, and was providing him some information about the animals presumed to be on different properties.

BY MS. McGEE:

Q. Do you remember what the information request

was?

MR. HESSLER: Objection, calls for speculation.

THE WITNESS: This was a response to an e-mail that he sent me, so I would have to see his exact e-mail to see specifically. But this -- this is the information I provided.

BY MS. McGEE:

Q. On the second page, the first line of that page, the first sentence in that first line begins, "Losing these animals from the landscape would impact any ability to reduce coyote introgression and our ability to manage wolf intact pairs." What did you mean by that?

A. This was sent in December of 2015. We had already stopped using sterilized placeholders -- putting additional sterilized placeholders on the landscape. So my concern was about managing additional coyote introgression into red wolf genome.

Q. And when you say "losing these animals from the landscape," what were you referring to?

A. Removing breeding adult wolves from their territories.

Q. And why were you very concerned about the fate of any animal we do remove from these areas? I am looking at the first full paragraph on the second page.

MR. HESSLER: Objection, vague.

THE WITNESS: I am concerned about every animal in the landscape. That is part of being in recovery.

BY MS. McGEE:

Q. Why would removing an animal from an area concern you?

MR. HESSLER: Objection, vague, calls for speculation.

BY MS. McGEE:

Q. What about removing an animal from the areas as discussed in this e-mail in Exhibit 70 concern you?

A. The biological implications of removing an animal from their occupied territory.

Q. And what are those biological implications?

A. The disruption of social dynamics in the pack and the potential redistribution of canids on the landscape.

Q. I am handing you what will be marked as Exhibit 71, Bates number USFWS-0013369.

(PLAINTIFFS EXHIBIT 71 WAS MARKED FOR IDENTIFICATION.)

(Witness peruses document.)

Do you recognize this document?

A. I recognize it as an e-mail that I sent Leo.

speculation and vague.

THE WITNESS: I don't recal. But, like, physically, it could be one day. I don't recall any of those cases at this time, but ---

BY MS. McGEE:

Q. Do you recall the longest amount of time that a red wolf was held at Sandy Ridge during your time with the Red Wolf Recovery Program?

MR. HESSLER: Objection, calls for speculation. And objection as to the vagueness of the question.

THE WITNESS: Yes.

BY MS. McGEE:

Q. How long was that?

A. Approximately eight to nine months.

Q. Why was that animal held eight to nine months?

MR. HESSLER: Objection. Calls for speculation and vague as to "the animal."

THE WITNESS: Are you referring to a specific animal?

BY MS. McGEE:

Q. You recalled that the longest amount of time an animal was held, during your time with the Red Wolf Recovery Program at Sandy Ridge was eight to nine months. In that specific instance, why was that animal being held

that long?

MR. HESSLER: Objection, calls for speculation.

THE WITNESS: The Program staff was waiting on instruction.

BY MS. McGEE:

Q. Waiting on instruction from whom?

MR. HESSLER: Objection, calls for speculation.

THE WITNESS: Our supervisory chain.

BY MS. McGEE:

Q. From Pete?

MR. HESSLER: Objection, calls for speculation.

THE WITNESS: Pete was my direct supervisor when that animal was removed.

BY MS. McGEE:

Q. So were you waiting to hear from Pete to release that animal?

A. I was waiting on instruction -- Pete or via Pete's supervisory chain, for instruction on how and where to put that animal back on the landscape. When I left the program in July of 2016, that animal remained at Sandy Ridge.

You know, I am sorry. I am mixing up my time

line a little bit. That animal was already in captivity when I left in July of 2016.

Q. Okay.

A. Sorry about that.

Q. That is fine.

A. Yes. It was not in -- it was not -- it was in the SSP facility, it was not in Sandy Ridge.

Q. When did it -- when was it transferred to the SSP facility?

A. November of 2015.

Q. After being held for eight to nine months?

MR. HESSLER: Objection, mischaracterizes prior testimony, calls for speculation.

THE WITNESS: I would have to review the individual case. I am afraid I am mixing up my dates now.

BY MS. McGEE:

Q. With that animal that we were just discussing that was held at Sandy Ridge, did you discuss with your staff the possibility of releasing that animal as soon as possible?

MR. HESSLER: Objection, mischaracterizes prior testimony as to where it is being held, and vague as to "as soon as possible."

THE WITNESS: The field staff expressed

concerns about that particular animal.

BY MS. McGEE:

Q. About releasing it as soon as possible?

MR. HESSLER: Objection, mischaracterizes prior testimony, vague, calls for speculation.

THE WITNESS: Concerns about holding the animal.

BY MS. McGEE:

Q. Why were they concerned?

MR. HESSLER: Objection, calls for speculation.

BY MS. McGEE:

Q. What did they express to you was their concern about holding the animal?

A. Holding the animal for a long amount of time.

Q. Why would that -- why was that concerning to them?

MR. HESSLER: Objection, calls for speculation.

BY MS. McGEE:

Q. Did they tell you why they were concerned about holding the animal for a long amount of time?

A. Yes.

Q. What did they tell you?

A. The concern about holding an animal past two

to three months was that it could potentially acclimated to human activity and not be a good release candidate back into the wild population.

Q. Was the animal that we were just discussing that was held for a long time placed into the SSP because it became acclimated to humans, as expressed by the field staff as being their concern?

MR. HESSLER: Objection, mischaracterizes prior testimony, calls for speculation and is vague.

THE WITNESS: The animal did not get put back onto the landscape. It got placed into a captive breeding facility at the end of its tenure at Sandy Ridge.

BY MS. McGEE:

Q. And why was it placed in a captive breeding facility rather than being released into the wild?

A. Because we held it for over three months, and it wasn't a good candidate to be reintroduced for that particular case.

Q. I am handing you what has previously been marked as Exhibit 16. Do you recognize this document?

A. I didn't write this document, but I was copied on it.

Q. Do you recognize it?

A. Yes. It is an e-mail from Art.

Q. Who is the e-mail to?
A. Leo.
Q. Do you know what happened to the wolves mentioned in Exhibit 16?
MR. HESSLER: Objection, calls for speculation, vague as to "what happened."
BY MS. McGEE:
Q. Do you remember these wolves that were being held in a pen at Sandy Ridge in February of 2015?
A. The male that is referred to as 11737?
Q. Uh-huh.
A. Yes, I know the fate of that animal.
Q. What was the fate of that animal?
A. He is at North Carolina Zoo currently.
Q. How long was he held at Sandy Ridge?
A. Eight to nine months.
Q. Do you know what other wolf Art is referring to when he says "both wolves captured on this property"?
MR. HESSLER: Objection, calls for speculation.
THE WITNESS: I don't remember the animal number specifically, no.
BY MS. McGEE:
Q. Do you know the animals fate?
MR. HESSLER: Objection ---

THE WITNESS: Yes.

MR. HESSLER: --- calls for speculation.

THE WITNESS: I -- I believe so.

BY MS. McGEE:

Q. What was the fate of that animal?

A. I would have to see if there was more than one animal removed from this -- from this property, so I would have to see the rest of the chain to be able to say which particular animal it is, with certainty.

Q. I am handing you what was previously marked as Exhibit 17. Does that help refresh your recollection at all?

(Witness peruses document.)

A. The animal numbers are still not here, so I can't attest to exactly what happened. I am assuming that one of the males that Art is referring to in this e-mail is also the one referred to in the other e-mail a month earlier, 11737. It says "The older female was captured." So these -- those are other -- two other animals.

Q. Do you know what happened to the animals not numbered 1173 [sic] as discussed in Exhibit 17?

MR. HESSLER: Objection, mischaracterizes prior testimony and the document. Also, calls for speculation and is vague.

THE WITNESS: The older female in this -- in this e-mail was noted -- she was euthanized due to health related issues. One of the males was the male referred to here that I already stated is at the North Carolina Zoo. And I don't remember the number of the other animal.

BY MS. McGEE:

Q. You would need the number of the other animal to know exactly what happened to it?

A. I would probably need more context, just because there are so many animals and so many numbers and so many removal requests.

Q. Sure. I am handing you what has previously been marked as Exhibit 10. On the second page, the second e-mail message from the bottom, from Art Beyer, includes mention of five coyotes captured and eight wolves captured in response to removal requests. Do you recall what happened to any of those eight wolves?

MR. HESSLER: Objection, calls for speculation. Also, objection as to the vagueness of "what happened."

THE WITNESS: I am not on the communication chain, so I don't know exactly what this was referring to specifically.

BY MS. McGEE:

and one in Manteo. I am referring to the Manteo one.

Q. And you were receiving questions about whether that sub-office was still primarily a Red Wolf Recovery Program. How did you answer those questions?

A. I referred them to someone in the program -- Pete -- at the parent office. He could delegate those questions.

Q. Is the sub-office primarily a Red Wolf Recovery Program office?

MR. HESSLER: Objection, calls for speculation.

THE WITNESS: When I left in 2016, the field staff were doing additional monitoring activities for species including the red wolves, but not restricted to red wolves.

BY MS. McGEE:

Q. And when you say the "field team," you mean the field team that prior to that time you just specified, were focused solely on red wolves?

MR. HESSLER: Objection, calls for speculation, mischaracterizes prior testimony.

THE WITNESS: The sub-office dealt with a variety of monitoring programs, because when we were folded into the Raleigh office. So when that changed in 2013, we were now operating under a different program,

and absorbed into their annual work plan and strategic plans. So some of those focuses were expanded to include duties that their office regularly maintained as the parent office.

BY MS. McGEE:

Q. And when were their duties expanded?

MR. HESSLER: Objection, calls for speculation, vague.

THE WITNESS: In general, over the tenure that I was there is part of that transition. So post December 2013, when our administration changed.

BY MS. McGEE:

Q. So it was a gradual change?

MR. HESSLER: Objection, vague as to "gradual."

THE WITNESS: It was -- occurred over the tenure that I was there.

BY MS. McGEE:

Q. Looking at this second page of Exhibit 75, the first line, who is Emily?

A. Emily Weller.

Q. And what role does she have in the Fish and Wildlife Service?

A. She is currently the Red Wolf Recovery Lead.

COURT REPORTER: The lead?

the last sentence, you talk about some of the successes of the program. Why do you say that you would not catagorize recent years as successful?

MR. HESSLER: Objection, vague as to the term "success." Calls for speculation and mischaracterizes the exhibit.

THE WITNESS: I say language like "Building on the foundation of work accomplished over the past two years and the past history undermines their hard work and successes for the past 30 years." I felt like the field team was successful for the duration of the program, at least from a biological perspective. Animals were producing in the wild right away, the population was growing, et cetera.

BY MS. McGEE:

Q. And then what did you mean in the last part of that sentence when you said, "Recent years of the program, hardly of which any of them were categorize [sic] as successful."

MR. HESSLER: Objection, vague as to the term "successful." Also calls for speculation.

THE WITNESS: We had a lot of personnel turnover and changes in the Program, which were difficult to deal with as a team.

BY MS. McGEE:

the witness' clarification of her testimony.

THE WITNESS: Again, the third -- the third written communication regarding a take authorization was another renewal of that first permit that I referenced in February 2014. So that series would be February 2014, the renewal in September in 2014, the second renewal in April 2015.

BY MS. McGEE:

Q. Do you recall any other take authorizations that were granted during your time with the Red Wolf Recovery Program?

MR. HESSLER: Objection, asked and answered.

THE WITNESS: Yes.

BY MS. McGEE:

Q. What take authorization was that?

A. There were two take authorizations issues in May of 2015 to two different property owners, separate from the first on that I referred to, with their renewals.

Q. Were those for different properties?

MR. HESSLER: Objection, asked and answered.

THE WITNESS: Yes. Different -- let me -- let me clarify. Different properties in multiple ways:

different properties from the first series that I just enumerated, and then different from each other. They were to two different land owners, two different properties.

BY MS. McGEE:

Q. And these three different take authorizations that you recall during your time with the Red Wolf Recovery Program, were any of them ever acted upon?

MR. HESSLER: Objection, mischaracterizes the witness' testimony, and vague as well as asks for speculation.

THE WITNESS: What do you mean, "acted upon"?

BY MS. McGEE:

Q. Did any of the private landowners who received a take authorization during your time with the Red Wolf Recovery Program lethally take a red wolf pursuant to that take authorization?

MR. HESSLER: Objection, vague, also calls for a legal conclusion.

THE WITNESS: As I indicated, there were multiple landowners, one with several renewals, and then two different ones issued at the same date. Those were for different properties for different landowners, but who shared an acting agent.

The landowner, to my knowledge, never lethally took a wolf. It was the farm manager as an acting agent who lethally killed a wolf with one of those take authorizations.

BY MS. McGEE:

Q. In your role with the Red Wolf Recovery Program, did you have authority to issue take authorizations?

MR. HESSLER: Objection, vague, calls for speculation.

THE WITNESS: I did not issue any take authorizations during my role -- during my tenure in any of my roles with the Recovery Program.

BY MS. McGEE:

Q. Did you ever recommend that a take authorization be issued?

MR. HESSLER: Objection, vague.

THE WITNESS: I didn't -- I don't recall recommending a take authorization being issued. With each removal requests, again, they were case-by-case bases. And I provided background biological information to the best of my ability.

BY MS. McGEE:

Q. Were you involved in the decision to issue the February 6th -- excuse me, the February 2014 take

authorization that you previously mentioned?

MR. HESSLER: Objection, vague as to "involved."

THE WITNESS: I was not involved in the issuing of the -- that specific letter. I was actually on my honeymoon. So I was on leave during that time. I certainly participated in conversations leading up to that decision. I was not involved in that decision directly.

BY MS. McGEE:

Q. Did you recommend that the lethal take permit be issued in that situation?

MR. HESSLER: Objection, asked and answered, vague, and calls for -- and mischaracterizes the witness' testimony.

THE WITNESS: I didn't make a recommendation, I expressed my concerns about issues being considered in the decision process.

BY MS. McGEE:

Q. Did you participate in the decision to renew that take authorization?

MR. HESSLER: Objection, vague, "participate."

THE WITNESS: Again, I don't recall making a specific recommendation. I certainly was involved in

communications about concerns relating to the take authorizations with my supervisory chain. I was not part of the decision making process for any of the take authorizations or renewals.

BY MS. McGEE:

Q. Did you make any recommendations to issue the take authorizations that were issued in May of 2015?

MR. HESSLER: Objection, vague as to "recommendations," and -- and this has been asked and answered at this point.

THE WITNESS: Again, I participated in discussions about factors being considered. I expressed my concerns, as I have indicated earlier, but I was not part of the decision making -- the decision making process for any of the take authorizations I mentioned or the renewals.

BY MS. McGEE:

Q. A moment ago, you mentioned that you expressed some concerns about issuing that first take authorization. What were your concerns?

MR. HESSLER: Objection, vague as to "concerns."

THE WITNESS: My concerns were multifaceted. That, you know, each of those is a case-by-case basis with a particular landowner that may

involve a long history of interactions, as was the case for the first take authorization, only part of which I was directly involved in during my tenure. It certainly pre-dates my involvement.

BY MS. McGEE:

Q. And so what were the concerns that you had that you expressed to others about ---

MR. HESSLER: Objection ---

BY MS. McGEE:

Q. --- that take authorization?

MR. HESSLER: Objection, asked and answered, vague as to the term "concerns."

THE WITNESS: Are you referring to some -- a particular concern or ---

BY MS. McGEE:

Q. A moment ago you had mentioned that you had concerns about issuing that take authorization. What were those particular concerns?

MR. HESSLER: Objection, vague as to the term "concerns," and asked and answered.

THE WITNESS: In those discussions leading up to those decisions -- again, which I was not involved in -- I expressed my -- my concerns, biologically, with potential impacts to the animals on the landscape.

BY MS. McGEE:

Q. And what would be those biological concerns and impacts to the animals on the landscape?

MR. HESSLER: Objection, vague as to "concerns" and "animals on the landscape."

THE WITNESS: The most direct concern is that it is a take authorization for a lethal take. So I had a concern about the direct mortality impact of the particular individual and how that could affect pack dynamics.

COURT REPORTER: Affect pack ---

THE WITNESS: Dynamics.

BY MS. McGEE:

Q. Do you recall when you first learned about that take authorization being renewed?

MR. HESSLER: Objection, vague as to the "take authorization."

THE WITNESS: Which renewal?

BY MS. McGEE:

Q. Do you recall when you first learned about the renewal of the February 6^{th} take authorization.

MR. HESSLER: Objection, vague as to the date. And which renewal?

BY MS. McGEE:

Q. The February 2014 take authorization that you were discussing previously, do you recall when you first

learned that it was renewed?

A. The first renewal was in September of 2015.

Q. Do you recall when you first learned that it was renewed?

A. I -- I don't. I would guess that we had discussions leading up into that point or whenever it was requested. I don't recall when it was requested.

Q. And similarly, when it was renewed again in April of 2015, do you remember when you learned of that renewal?

A. That renewal -- so each renewal is 180 days after the original issuance, so I don't -- I don't know -- I don't remember when the landowner requested that. I would -- I would assume that it was after the 180 days or near the 180 days. So it would probably be around those times that we were having those discussions.

Q. And each time the take authorization expired, did you or your staff go out and attempt to capture wolves again on that landowner’s property?

MR. HESSLER: Objection, vague, also calls for speculation.

THE WITNESS: There were multiple renewals, as I indicated, and multiple take authorizations issued. So each of those were case-by-case. I would have to recall whether we were given that opportunity or not.

BY MS. McGEE:

Q. I am handing you what will be marked as Exhibit 77, Bates number 12588.

(PLAINTIFFS EXHIBIT 77 WAS MARKED FOR IDENTIFICATION.)

(Witness peruses document.)

Do you recognize this document?

A. It is an e-mail chain, part of which I am included on.

Q. What part are you included on?

A. I am not included on the original correspondence. It was -- I think it was forwarded to me.

Q. And turning to the second page of the document, looking at the e-mail that you sent on May 20th, 2015, were -- did you previously know about the renewal of the September take authorization mentioned in this e-mail?

MR. HESSLER: Objection, vague as to "September take authorization."

THE WITNESS: The September -- I am referring to a different landowner than is referred to in the original e-mail that I was forwarded.

BY MS. McGEE:

Q. Looking at this e-mail, does this -- this

e-mail being the one that you wrote on May 20th -- does it refresh your recollection as to when you first learned about the renewal of the take authorization that was previously issued in September?

MR. HESSLER: Objection, vague as to "the take authorization."

THE WITNESS: Yes. So this is dated May 20th. I had been given the September renewal, which was the first renewal for a landowner that is different. I indicate that I know there were drafts of subsequent renewals, but I had not received it at this time -- the e-mail under that demonstrates that Pete sent me at that date.

BY MS. McGEE:

Q. And looking at the third page on this e-mail chain, at the very top of that chain, there is an attachment listed. What is the date of that attachment?

MR. HESSLER: Objection, calls for speculation.

THE WITNESS: I am just reading what is here. I didn't send it, but the date in the attachment that you are referring to is April 27th, 2015.

BY MS. McGEE:

Q. And is that, to your recollection, when the September take authorization was renewed?

MR. HESSLER: Objection, calls for speculation.

THE WITNESS: As the e-mail chain indicates that I wrote on May 20th, I hadn't seen a second take renewal until then. I don't -- I am not sure when I received the September one, but I had obviously gotten it by May 20th.

BY MS. McGEE:

Q. Right. So had you investigated this landowner’s property prior to the April renewal of the take authorization?

MR. HESSLER: Objection, vague as to "this landowner."

THE WITNESS: There is several landowners in the chain.

BY MS. McGEE:

Q. The landowner that is referenced for the renewal of the take authorization, as you mention in the May 20th e-mail?

A. In my e-mail, I am referring to a landowner who was issued the original letter in February of 2014, the renewal in September 2014, and the second renewal in April 27th 2015. I personally was not on that property.

The -- and my supervisory role at the field staff changed in the middle of that tenure, so I was not

S I G N A T U R E

I HAVE READ THE FOREGOING PAGES 5 THROUGH 235 WHICH CONTAIN A CORRECT TRANSCRIPT OF THE ANSWERS MADE TO THE QUESTIONS HEREIN RECORDED. MY SIGNATURE IS SUBJECT TO CORRECTIONS ON ATTACHED ERRATA SHEET, IF ANY.

Rebecca Harrison

(SIGNATURE OF REBECCA B HARRISON, Ph.D.)

STATE OF North Carolina

COUNTY OF Dare

I CERTIFY THAT THE FOLLOWING PERSON PERSONALLY APPEARED BEFORE ME THIS DAY, AND I HAVE PERSONAL KNOWLEDGE OF THE IDENTITY OF THE PRINCIPAL OR HAVE SEEN SATISFACTORY EVIDENCE OF THE PRINCIPAL'S IDENTITY, OR A CREDIBLE WITNESS KNOWN TO ME HAS SWORN TO THE IDENTITY OF THE PRINCIPAL, ACKNOWLEDGING TO ME THAT HE OR SHE VOLUNTARILY SIGNED THE FOREGOING DOCUMENT FOR THE PURPOSE STATED HEREIN AND IN THE CAPACITY INDICATED:

Rebecca B Harrison

(NAME OF PRINCIPAL)

6/29/2017

(DATE)

D Twyne McPherson

(SIGNATURE OF NOTARY)

D Twyne McPherson

(NOTARY'S PRINTED NAME)

D. TWYNE McPHERSON
NOTARY PUBLIC
DARE COUNTY, NC
My Commission Expires 3/18/19

(OFFICIAL SEAL)

****

I, TERRENCE X. McGOVERN, NOTARY/REPORTER, DO CERTIFY THAT THE FOREGOING TRANSCRIPT WAS DELIVERED TO THE WITNESS EITHER DIRECTLY OR THROUGH THE WITNESS' ATTORNEY OR THROUGH THE ATTORNEY RETAINING THE WITNESS ON ______________________, AND THAT AS OF THIS DATE, I HAVE NOT RECEIVED THE EXECUTED SIGNATURE PAGE OR ERRATA SHEET.

THEREFORE, MORE THAN 30 DAYS HAVING ELAPSED SINCE THE RECEIPT OF THE TRANSCRIPT BY THE WITNESS, THE SEALED ORIGINAL TRANSCRIPT IS HEREBY FILED WITH THE ORDERING ATTORNEY BY MEANS OF PRIORITY MAIL, IN ACCORDANCE WITH THE NORTH CAROLINA RULES OF CIVIL PROCEDURE.

(DATE)

TERRENCE X. McGOVERN, NOTARY/REPORTER
NOTARY NUMBER 19933480053
MY COMMISSION EXPIRES AUGUST 4, 2019

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF NORTH CAROLINA
NORTHERN DIVISION

RED WOLF COALITION, DEFENDERS OF WILDLIFE, AND ANIMAL WELFARE INSTITUTE,	)	
PLAINTIFFS,	)	
V.	)	NO. 2:15-CV-42-BO
THE UNITED STATES FISH AND WILDLIFE SERVICE, DAN ASHE, IN HIS OFFICIAL CAPACITY AS THE DIRECTOR OF THE UNITED STATES FISH AND WILDLIFE SERVICE; CYNTHIA K. DOHNER, IN HER OFFICIAL CAPACITY AS REGIONAL DIRECTOR OF THE UNITED STATES FISH AND WILDLIFE SERVICE SOUTHEAST REGION,	)	
DEFENDANTS.	)	

DEPOSITION OF ARTHUR BRUCE BEYER

TUESDAY, MAY 30, 2017

GOVERNOR'S BOARD ROOM

RALEIGH MARRIOTT CITY CENTER

500 FAYETTEVILLE STREET

RALEIGH, NORTH CAROLINA

9:01 A.M.

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PROPERTY

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EXHIBITS (CONT'D)

Q. How long were you in the wildlife biologist supervisory position?
A. I was in that role until it was 2015 -- June 2015, yes.
Q. And what happened then?
A. I took a position with Refuges as a Wildlife Refuge Specialist.
Q. Is that your current role?
A. Yes.
Q. Did you change offices when you changed positions?
A. Can you be more specific?
Q. Sure. The office space that you had as a supervisory biologist, did that change when you started working for Refuges?
A. The specific office changed, but not the building, yeah.
Q. Same building?
A. Yes.
Q. Better office, I hope?
A. Well, it is quieter on that end of the building.
Q. Fair enough. So were you always based out of that same building in Manteo?
A. Yes.

A. Effectively, an assistant manager.
Q. And what does that mean?
A. Good question. Helping to manage maintenance, biology coordination with the public, you know, working with our public affairs folks.
Q. So how often are you in the field or out of the office?
A. About 50 percent.
Q. Is that about the same as when you were working with the Red Wolf Recovery Program?
A. It just depended. It really depended on time of year and what we were doing.
Q. Are you still involved with the Red Wolf Recovery Program?
A. Uh-huh.
MS. WILLIAMS: Objection. Vague, "involved."
THE WITNESS: And what -- can you clarify "involved"?
BY MS. McGEE:
Q. Do any of your work responsibilities still pertain to the Red Wolf Recovery Program?
A. Yes.
Q. Could you please tell me which ones?
A. Some data entry still, if there is a request

for assistance in the field. I am trying to think. If it is helping send off blood work for analysis.

Q. What sort of data entry do you do for the Red Wolf Recovery Program currently?

A. Mortality data, capture data, birth events.

Q. And who communicates that data to you?

A. Usually, one of the biologists on the Red Wolf Program.

Q. And who are the biologists on the Red Wolf Program currently?

A. Michael Morse, Ryan Nordsven.

Q. What sort of requests for assistance in the field do you receive currently related to the Red Wolf Recovery Program?

MS. WILLIAMS: Objection. Assuming facts not in evidence.

THE WITNESS: Could you restate that?

BY MS. McGEE:

Q. So a moment ago I believe you said that some of your current responsibilities include responding to requests for assistance in the field, as related to the Red Wolf Recovery Program. Could you tell me what sort of requests for assistance you have received in your current position related to the Red Wolf Recovery Program?

A. So, for example, help with locating a den -- a red wolf den.

Q. And how do you help with locating a den?

A. It is radio telemetry on the female.

Q. So you are doing the radio telemetry for the Red Wolf Recovery Program staff?

A. In this case, someone else did the telemetry. It was just helping physically find the den, itself.

Q. Why did they ask for your help with that?

A. Part of it is, I think, my experience in knowing what to look for. Part of it is, as you find a den, is knowing how to handle pups and that procedure.

Q. How long have you worked with or handled pups in the wild?

A. I believe, since 2000, 1999, somewhere around there.

Q. A few decades?

A. Almost.

Q. And then, finally, you also mentioned that you still are helping with sending off blood work for analysis for the Red Wolf Recovery Program. Who collects the blood work?

A. That would be one of the biologists.

Q. When did you last send off some blood work for analysis?

1989?

A. Yes. Uh-huh.

Q. When you started, did you receive any sort of training about the goal of the program?

MS. WILLIAMS: Objection, vague.

THE WITNESS: Yeah, if you could clarify that.

BY MS. McGEE:

Q. Sure. What was the goal of the Red Wolf Recovery Program when you first started working with the program?

A. Let me think. I think -- my understanding was recovery of the species in the wild.

Q. And were there short-term goals that you were directed to work toward in order to achieve recovery of the species in the wild?

MS. WILLIAMS: Objection, vague, "short-term goals."

THE WITNESS: Yeah, I don't think so.

BY MS. McGEE:

Q. When you started, what were the key management actions of the Red Wolf Recovery Program in order to achieve recovery of species in the wild?

A. Can you define "management actions"?

Q. Sure. What sort of programs or specific

procedures or activities would you, as the staff, undertake with the goal of achieving recovery of species in the wild?

A. Primarily radio telemetry and capture efforts.

Q. And how did radio telemetry relate to recovery of species in the wild?

A. Well, radio telemetry -- my understanding, radio telemetry helped us understand and track individual wolves and the population as a whole.

Q. Uh-huh. And then how about capture efforts? How did capture efforts relate to or support recovery of species in the wild?

A. Primarily, capture efforts allowed us to put radio collars to do radio telemetry.

Q. Any other specific actions that you, as the staff, would take with the goal of assisting recovery of red wolves in the wild?

A. I guess, releases of captive wolves.

Q. Could you explain what you mean by "releases of captive wolves"?

A. Well, in the beginning of the program, to get wolves on the ground, it had -- required the release of captive wolves. To further augment the population, either in numbers or potentially genetic component, it could be releasing wolves from captivity, either as an

adult off of an island site or as a puppy into a den.

Q. And how often did releases occur?

A. I think that really depends on the time of year and circumstances.

Q. What time of year did you typically release wolves ---

A. (Interposing) Or ---

Q. --- into the wild?

A. Yeah, I am sorry. Well, it could be time of year. More adult captive releases, at least of older animals from zoo settings, took place early in the program. I think it was sporadic. From that point on, with regards to island wolves, fostering puppies in the dens was opportunistic in the spring, at best.

Q. When did you first start fostering pups into dens? And when I say "you," I mean the Recovery Program, generally?

A. I don't remember the first year, but it was in the 2000s, probably.

Q. In 2000s?

A. Yeah.

Q. And could you please explain what you mean by "fostering pups into dens"?

A. It is -- it is taking usually a one -- one or two-week-old puppy from a captive setting -- a zoo,

finding a wild den that only has a couple of wild wolves. And you just put them in the den.

Q. And did you assist with those fostering events regularly from the 2000s onward?

MS. WILLIAMS: Objection, vague.

THE WITNESS: Could you repeat that?

BY MS. McGEE:

Q. Did you assist with pup fostering events in the early 2000s?

A. Yes.

Q. And when did you stop assisting with pup fostering events?

A. I don't remember the year.

Q. Okay. Were there any other management actions that the Red Wolf Recovery Program staff undertook to assist recovery of red wolves in the wild?

A. Yeah, I think that -- probably, the biggest action would have been sterilization of coyotes. Fostering -- let me see. Capture -- I think that is probably it.

Q. Did you ever vaccinate wild animals?

A. Yes, yes.

Q. How frequently did you vaccinate wild red wolves?

A. We usually vaccinated red wolves any time we

remember what year we stopped.

Q. So approximately where this chart ends?

A. I think so.

MS. WILLIAMS: Can we have it stated clear in the record that when you say the chart ends, it is 2012 to 2013?

MS. McGEE: Yes.

BY MS. McGEE:

Q. Okay. Do you need a break at all?

A. I am fine. Thank you.

Q. I am putting before you what will be marked as Exhibit 3.

(PLAINTIFFS EXHIBIT 3 WAS MARKED FOR IDENTIFICATION.)

And I do have smaller printouts to hand out, as well. Do you recognize this map?

A. Yes.

Q. Could you please tell me what this map depicts?

A. This looks like the five county recovery area of the Red Wolf Recovery Program.

Q. To the best of your knowledge, is it an accurate and fair representation of the Red Wolf Recovery area?

A. Yes. This is one of those moments when I want

to clarify something I said earlier. When you had asked me about working with other federal agencies, we have worked with the Department of Defense on Alligator River Refuge, and I had forgotten about that.

Q. Thank you. And could you tell me in what capacity you worked with the Department of Defense?

A. Usually just coordinating access roads through a bombing range, which is important.

Q. Which bombing range is that?

A. This would be the Dare County bombing range.

Q. And who was your point of contact?

A. That varied year to year. It really did.

Q. And did you do anything other than coordinating access with DOD?

A. Well -- so it was coordinate access to do telemetry or capture efforts. Yeah.

Q. So you sometimes had wolves on the bombing range?

A. Yes.

Q. All right. Could you pick up a blue marker and circle, generally, the limits of where you worked within the Red Wolf Recovery area?

A. Could you define what time period?

Q. Sure. During any time that you were with the program?

A. Any time?
Q. Yes.
A. So I can circle the whole thing ---
Q. You could.
A. --- roughly? Because just about all -- the whole area.
(Witness complies.)
I don't think I was ever down there (indicating).
A. Great.
Q. So it looks like you did not circle some of the Red Wolf Recovery area south of Pamlico River?
A. Yeah, I don't -- I don't remember ever going down there. I flew over there, but I didn't -- I didn't spend time on the ground there, from what I can remember.
Q. Okay. So you did fly in that area?
A. Yes.
Q. But now what you have circled is where you have spent time on the ground within the Red Wolf Recovery area?
A. Roughly.
Q. Roughly, sure.
A. Yes, yes.
Q. Can you place stickers on this map where you have worked with packs of red wolves during your time

with the Red Wolf Recovery Program?

A. Certainly some.

Q. Sure. And that is fine.

A. The ones I can remember.

Q. And I have got these red stickers we can use for red wolves.

A. Where I have worked with packs of red wolves, is that correct? We are going to need more stickers.

(Witness complies.)

Well, another one. I like stickers.

Q. Who says depositions can't be fun?

A. No kidding. Yeah. Let's see here. Also, can I -- before I keep going, though, can I clarify, when you say "works with packs," is that -- what was the question again that I am marking?

Q. Yes. So where packs of red wolves have occurred in the Red Wolf Recovery area.

A. Okay. Okay.

Q. Does that change anything that you have done already?

A. No, no, no, no. No, I mean -- yeah. It doesn't change anything, yeah.

Q. Okay. Thank you for clarifying.

A. Definitely going to run upstairs. So just keep doing red?

Q. Sure.

A. Also, just so -- my definition, too, of a pack could be a pair ---

Q. That is fine. Thank you.

A. --- now that I have put all those on here. I had one up here (indicating). That is the bulk of them. There is a couple I can't remember if we had pairs there or not.

Q. That is fine. And as we walk through some of those, if you remember others, just let me know.

A. Okay. Yeah, that is -- if I put on any more, I am not sure I am going to remember correctly.

Q. So to clarify, you have placed a sticker where you recall a pack, which could consist of a pair, of red wolves occurring within the Red Wolf Recovery area during your time with the Red Wolf Recovery Program?

A. Yes.

Q. Great. So walking through these, let's start with this (indicating).

A. Okay.

Q. When did this pack or pair exist, and what do you recall about it?

MS. WILLIAMS: I am going to object. You will need to state clearly where on this map you are pointing to. These red dots have no markers on them.

MS. McGEE: We are going to number them and label them as we go.

MS. WILLIAMS: Okay.

MS. McGEE: Yes.

THE WITNESS: I don't remember the first year they occurred there. We called it the -- probably the Shirley or the -- where are the -- what is that called? I think that was probably the Shirley pack Farm -- or Shirley Farm pack.

BY MS. McGEE:

Q. The Shirley Farm pack? And since the map is facing you, could you just put a number "1" next to the Shirley Farm pack?

(Witness complies.)

Great. Thank you. And you said you don't remember exactly when?

A. No, not exactly.

Q. Generally, in the '90s or the 2000s?

A. It is probably early 2000s.

Q. And how many members were in the pack?

A. Depending, anywhere from two -- I think they might have had pups one year, two years.

Q. And then let's go with this one. And can we go ahead and we will put a number 2 to it to start?

A. Yeah. And this is what -- just to clarify

again ---

Q. Sure.

A. --- what I think will be difficult is -- so for this example, it could be -- this could be a number of different packs over the years. Some ranged from the north, some ranged further south, anywhere from one group that never had pups to groups that had multiple litters. So it is -- I think it is going to get real tricky on specifics on some of those.

Q. That is okay. And walking us through those specifics is helpful.

A. Okay.

Q. So it sounds like potentially a number of different packs have held territory ---

A. Yeah.

Q. --- where we have labeled number two?

A. Uh-huh. Yeah.

Q. Uh-huh. So starting with the earliest pack that you can recall, when was that?

MS. WILLIAMS: I am going to object as to your mischaracterization of prior testimony.

BY MS. McGEE:

Q. You can go ahead.

A. What was your question?

Q. My question was ---

MS. WILLIAMS: Objection.

BY MS. McGEE:

Q. --- what is the earliest pack that you recall in that area of what has been marked as number 2?

A. Yeah, again, that may have been -- my recollection, maybe the middle to late '90s, I think.

Q. Did you have a name for that pack?

A. We did. We had multiple names. And all of these have multiple names.

Q. Of course.

A. And I don't -- that is -- I am trying to remember which one we called this. This could have been over east or -- Beech Ridge. I think we called it Beech Ridge at one point.

Q. Okay. And recognizing that this pack was fluid over time, how many ---

MS. WILLIAMS: (Interposing) Objection as to characterization of prior testimony.

BY MS. McGEE:

Q. --- how many wolves were in that pack at its peak?

A. I don't remember. There were so many -- there were just too many packs.

Q. Sure.

A. Yeah.

Q. Were there ever more than just a breeding pair ---
A. Yes.
Q. --- in that pack? Was there -- did that breeding pair -- did a breeding pair within that territory of number 2 ever have a litter?
A. Yes.
Q. And did members of that litter ever stay with that breeding pair?
A. Yes.
Q. And did some members disperse elsewhere?
A. Yes.
Q. It sounds like a pretty successful pack?
A. Yes.
Q. Great.
MS. WILLIAMS: Objection.
BY MS. McGEE:
Q. Let's move on. Why don't you take me to which one you want to discuss next.
A. I will just -- because it is close.
Q. You are marking that as number 3?
A. Oh, this is Beech Ridge.
Q. That is Beech Ridge. Great.
A. I knew that something was wrong.
Q. That is okay. So Beech Ridge was not number

2; Beech Ridge was number 3?

A. Yes, yes.

Q. What do you remember about Beech Ridge, as far as numbers in the pack?

A. I think very similar. We had some that had litters and some that didn't. But I think that we have had multiple litters on that property, or in that pack. I shouldn't say that property.

Q. And during what years has there been a pack at Number 3?

A. I can't remember all the years. It probably started in the -- sometime in the '90s, maybe. '90s -- late '90s, and fairly consistent.

Q. Great. Then let's go up to this one (indicating) and mark it number 4.

A. Yeah, that was ---

Q. Thank you.

A. --- usually Pocosin Lakes.

Q. And how long has there been a pack there?

A. Probably off and on since -- gosh, possibly the early '90s -- early to mid '90s.

Q. And pretty consistently?

A. Off and on.

Q. And how many members were typically in that pack?

A. Again, anywhere from two to a number of litters.

Q. Now, if you can label this one number 5, how long or during what years was a pack there?

A. I think that is also maybe mid-'90s to late '90s. Not as consistent, but we have had multiple litters there.

Q. Okay. So you said mid '90s to late '90s. Was that the start or was that ---

A. (Interposing) Yes. That was probably the start.

Q. Okay. So there was a pack after the late '90s at that location?

A. Yes.

Q. Okay. And, again, approximately how many members in the pack?

A. A pair to multiple litters, yes.

Q. And then label this one number 6. Approximately during what years was there a pack?

A. This was -- I think this group was -- it might have been the early 2000s.

Q. That was the start of when a pack was there?

A. Yeah. Early to mid 2000s, maybe, yes. There was a pair there. They did have -- well, one litter.

Q. One litter? So did that pack not last very

long there?

A. I don't -- no.

Q. Do you know approximately when the pack ---

A. (Interposing) I don't remember what year.

Q. --- no longer held territory?

A. No. I believe that ---

MS. WILLIAMS: Objection. Mischaracterization as to prior testimony.

BY MS. McGEE:

Q. Can you label that one number 7? And, again, approximately during what years was there a pack at number 7?

A. That was probably the mid -- mid '90s all the way through 2000 -- early 2000s, maybe.

Q. So there is -- the pack ceased to be there ---

A. Correct.

Q. --- around mid-2000s?

A. Yes.

Q. And approximately how many animals were in that pack?

A. That, again, was a pair to probably several litters.

Q. Several litters? Okay. And did you have any other names for some of these? I know we talked about number 3 was Beech Ridge?

A. Four, Pocosin Lakes. Five was F2. Six -- I don't recall if that was -- might have been Blue Stone. But they might have been (inaudible). Seven was Western.

Q. Western?

A. Yes.

Q. Okay. Let's make this one number 8, right above number 7. And approximately during what years were there wolves holding territory there?

MS. WILLIAMS: And I am going to object to term "holding territory." Mischaracterizes prior testimony.

THE WITNESS: Do you want to clarify that?

BY MS. McGEE:

Q. If you understand, you can answer.

A. Well, as far as a pack, I think we had a -- the first year of a pack -- let's see. It was probably the -- probably the late '90s, early 2000s.

Q. That was the start of the pack being there?

A. I think so. That was a tricky one, because we had a group that moved quite a bit around an area and encompassed a lot. And it kind of split and changed. And so, you know, that is -- that is a confusing one. But that was probably most often called Tyson.

I don't remember if we ever called that -- no. that was a -- that was a group, actually, a -- I may have

had a group up here, but I can't remember. We had something called North Phelps. But this could have been Tyson, could have been Bee Tree, could have been -- I don't think I ever called it Bee Tree, though, because it was usually Tyson. Yeah. And, again, that was a pair to several packs.

Q. Pair to several packs?

A. Several litters.

Q. Got it. And you mentioned that it was a kind of fluid pack there, where it broke off, I think you said, and moved around. Could you tell me more about what happened?

MS. WILLIAMS: Objection. Mischaracterizes his prior testimony.

THE WITNESS: I think what settled there was a break-off of a nearby pack, yeah.

BY MS. McGEE:

Q. Okay.

A. So the names sometimes over -- crossed over.

Q. Makes sense. Okay. So we are labeling this as number 9. And can you tell me number 9, approximately when wolves inhabited that area, or when there was a pack at that location?

A. I think that was probably mid-90s. It was in the '90s. And we may have called that Tyson at one

point. It was called Sunnyside at one point. It has been called Northern. I think that is it.

Q. And it started in the '90s and continued on ---

A. Yes.

Q. --- from then pretty consistently?

A. Pretty -- pretty consistently, yes.

Q. And again, approximately how many wolves?

A. Again, a pair to several litters. Yes.

Q. We will make our way back down in a minute. So let's mark this as number 10. And approximately when did the wolves or a wolf pack inhabit that approximate location?

A. That was probably the early 2000s.

Q. Early 2000s, okay.

A. I think. That was probably either just call that Weyerhaeuser, or I may have called that Columbia. Yeah. And that was a pair -- yeah. They had several litters.

Q. Several litters? Okay.

A. But not as consistent.

Q. Not as consistent?

A. Correct.

Q. And what do you mean by "not as consistent"?

A. So I get a lot of these -- the original pack

may die off, leave, something happens, and you may have new wolves that establish and form nests -- a new pack. They are still called the same thing, but there might be a time gap in between there, or there is -- we know of one wolf, but not the other. So we are not identifying a pack.

Q. And when you say "new wolves might establish a pack," where do those new wolves come from?

A. Could have come anywhere in the population. Dispersers.

Q. Dispersers?

A. From another pack.

Q. Did you ever release wolves from the captive population to form a pack?

A. We released wolves. I don't know, though -- I really don't know if they were captive or if it was a dispersing wild wolf that we had caught and released.

Q. You are talking still specifically about number 10, here?

A. Yes. Yes.

Q. Okay. Let's go here and make this number 11. Same question. Let me get the question out for the transcript, though.

A. Right, right.

Q. So number 11, approximately what dates were

there a red wolf pack or pair at this location?

A. I think this was -- might have been the mid-2000s or later.

Q. And so the mid-2000s or later is when the pack first started there?

A. Right.

Q. Was it pretty consistent after that?

A. No.

MS. WILLIAMS: Objection. Vague as to the term "consistent."

THE WITNESS: Yeah. I don't -- we did not have a pack there as long -- or for very long.

BY MS. McGEE:

Q. Okay. Do you know about how long you did have a pack there?

A. Maybe a few years.

Q. And approximately how many members were in that pack?

A. Well, it was the pair, and then -- let's see. Did they have a litter? I believe they had a litter.

Q. Okay.

A. I can't recall if there was more than one.

Q. Let's make this number 12.

A. Okay.

Q. And at number 12, approximately what dates

were there a pack or pair holding territory?

A. I think ---

MS. WILLIAMS: I am going to object, again, to that term "holding territory." Mischaracterizes his prior testimony.

THE WITNESS: I think we first saw a pack in that area the late '90s.

BY MS. McGEE:

Q. Late '90s? And how long did that pack persist or a pack continue to hold territory?

MS. WILLIAMS: Objection.

THE WITNESS: We have had wolves in that area, off and on, pretty consistent, but different pack members.

BY MS. McGEE:

Q. Okay. And approximately how many members were usually in that pack?

A. We had paired several litters. Yes.

Q. Let's make this number 13.

A. Okay.

Q. And during what dates was there a pack or pair of wolves located in that general area?

A. I think we had wolves seizing (phonetic) that area, or a pack -- gosh -- probably the early to mid-2000s, I think.

Q. And did that pack or a subsequent pack consistently hold territory or be located in that area from that time period on?

MS. WILLIAMS: Objection as to the term "hold territory." Mischaracterizes prior testimony.

THE WITNESS: We had a group use that area. This didn't last as long. I don't remember how many years.

BY MS. McGEE:

Q. Okay. And about how many animals?

A. That would have been the pair. I don't recall if they had a litter or not.

Q. Okay.

A. Yeah, I don't remember.

Q. Okay. And do you have any particular names for these last few packs?

A. I do, if I can remember them. And I just realized I should have one up here.

Q. Do you need another sticker?

A. Yeah. This one, I believe we called Goose Creek.

Q. And that is number 12 you are pointing at as Goose Creek?

A. We called them Goose Creek or sometimes we called it Frying Pan. This one was called Over Swamp.

Q. And that is number 13 that you are pointing at?

A. That is 13.

Q. It is Over Swamp?

A. Yeah, Overswamp. It is the name of a road. Yeah. Eleven was Little Alligator.

Q. And did we already name 10, or did 10 have a name?

A. I think that was Columbia or Weyerhaeuser.

Q. That is right. Thank you. The sticker that you just added, can we number that 14?

A. Fourteen?

Q. And will you please tell me the approximate dates that a wolf pack or a pair existed in that area?

A. Yes. And that was, I think, probably around the late '90s that that began.

Q. So the late '90s that it began. And did a pack then consistently live in that area?

A. That group -- we have had wolves using that on and off -- I believe when I was thinking 12 earlier, I was thinking of this one. 12 -- the one we called Goose Creek or Frying Pan, is -- that one has been fairly consistent. 14 has been on and off a little bit more.

Q. Okay. So number 12, from about the early or late '90s, mid 2000s onward ---

A. Uh-huh.
Q. --- there was usually a pack or a pair of wolves located there?
A. Yeah, usually. Yes.
Q. And then number 14, it was not as regular of ---
A. I don't think so.
Q. Okay.
MS. WILLIAMS: And I am going to object to your characterization of dot 12 as the time period being from the mid '90s to 2000s.
BY MS. McGEE:
Q. During that time period -- again, for dot 12 -- did you say that red wolves existed in that area? That a pack or pair of red wolves existed in that area, excuse me.
A. I don't remember.
Q. Okay.
A. Yeah, I really can't remember. Probably mid -- probably mid to late '90s, but ---
Q. So the start would have been around the mid to late '90s. And then a pack or a pair was generally in that area from then onward?
A. Yes, I think so.
Q. Okay. Thank you. All right. Let's number

this one 15. And during approximately what dates were there -- was there a pack or a pair of red wolves in that area?

A. That one, I believe, was the early '90s.

Q. That was the start of that pack?

A. Yes.

Q. In the early '90s? And did a pack or pair continue to occupy that area from then onward?

A. I believe so.

MS. WILLIAMS: Objection. Vague as to term "then onward."

THE WITNESS: Yeah, I -- I -- we have had groups of wolves using that area fairly consistently. There may have been a couple of gaps, but I think that one is fairly consistent use.

BY MS. McGEE:

Q. So there were wolves fairly consistently using that area from the late '90s until ---

A. Early '90s.

Q. Early '90s, sorry. Thank you. So there was a group of wolves consistently using dot number 15 from approximately the early '90s until when?

A. I don't know. I think that was after I left.

Q. Okay. Can we number this 16?

(Witness complies.)

And for number 16, during what dates was there a red wolf pack or pair usually holding that area?

MS. WILLIAMS: And I am going to object as a mischaracterization of prior testimony.

THE WITNESS: We -- we had -- we had a group using that in the early '90s -- that area. But it hasn't been -- that area has not been as consistent. And it is ---

BY MS. McGEE:

Q. And when you say it has not been as consistent, what do you mean?

A. We have not seen wolves using that area as often. It is more sporadic. And we have had some groups that used it for a number of years, but, you know ---

Q. So when that first pack was using that area marked as number 16, did something happen that the pack stopped using it?

A. I don't remember.

Q. Okay.

A. I don't remember that group as well.

Q. And approximately how many members were in that pack?

A. Can you clarify which ---

Q. So the first pack?

A. The first pack? That was just a pair and a

few pups.

Q. Okay. So there was a litter?

A. That was a captive release.

Q. The pups were a captive release?

A. I think the whole group was.

Q. The whole group. Would they have all been a related family unit ---

A. (Interposing) Yes.

Q. --- when released?

A. Yes.

Q. Okay. And then subsequent packs or pairs came into that area?

A. Yeah. We have had -- yes. We have had several pair and several litters.

Q. Okay. And with dots number 15 and 16, did you have names for either of those packs?

A. 15, I think, was always Kilkenny. Sixteen was, I think, Rich Farms. I don't know if it had another name associated with it.

Q. And real quick, what does the term "holding territory" mean to you?

A. It is a home range, roughly.

Q. And when you say that wolves were using a particular area, what do you mean by that?

A. A home range.

Q. Thank you. Let's mark this as number 17.

(Witness complies.)

And for number 17, during what dates was there a pack or pair of wolves using or holding territory?

A. I think we had a pack there in the early '90s.

Q. So the pack started in the early '90s?

A. I believe so.

Q. And how long did that pack last?

MS. WILLIAMS: Objection. Ambiguous.

THE WITNESS: Yeah, could you clarify that?

BY MS. McGEE:

Q. Sure. How long did that pack hold territory there? For what time period?

A. I don't remember. I don't remember that pack, specifically.

Q. During what time period did wolves continue to use territory marked at 17?

A. That one, we have had wolves as a pack use that off and on at least until the mid 2000s -- late 2000s, I believe.

Q. Were there ever any litters born there?

A. Yes.

Q. Approximately how many litters were born in that area marked as 17?

A. I can't remember.

Q. So a lot?
A. This is a fair -- we had a fair number of litters, yes.
Q. Okay. And do you have any general sense of approximately how many members were usually in that pack?
A. It varied. It just varied so much.
Q. Sure.
A. Yeah.
Q. And was there any sort of name for that one, for that pack marked as 17?
A. Usually either White Tail or -- there is another name. Sometimes Weyerhaeuser -- we called that one Weyerhaeuser, maybe. LeMar Beach. That one has had a few -- a few names.
Q. And I think there was another dot that you had said was sometimes called "Weyerhaeuser," right?
A. Yes. We have several Weyerhaeusers.
Q. Okay. Good to know. Let's go ahead and call this one number 18.
A. Okay. Another Weyerhaeuser.
Q. Another Weyerhaeuser. Any other names?
A. Rose Bay.
Q. Groves [sic] Bay?
A. Rose Bay.
Q. Rose Bay?

A. Yes.

Q. Okay. And number 18, during what time periods was there a pack or pair of wolves holding territory?

A. Probably the early 2000s.

Q. That was the start of a pack holding territory there?

A. I think so.

Q. And for how long did a pack persist in that area?

MS. WILLIAMS: Objection. Vague as to term "persist."

THE WITNESS: Yeah. We have had -- let me think. We have had wolves -- again, that is -- we have had wolves use it off and on as a group.

BY MS. McGEE:

Q. Okay. Was there a group -- was a group of wolves pretty consistently using that area.

MS. WILLIAMS: Objection. Vague.

THE WITNESS: We did have -- I recall one pack that used that area several years.

BY MS. McGEE:

Q. Several years in a row?

A. Yes.

Q. And when that pack was no longer using that area, what happened?

A. Can you clarify?
Q. Did other pack come in and start using that territory after that pack?
A. I don't remember if that was that pack or not. Yeah.
Q. Okay. So what time periods were there not wolves using this territory marked as 18?
A. Gosh, probably -- I don't know. I don't know. I just can't remember the year. You know, that was after the mid-2000s.
Q. After the mid 2000s, wolves stopped using territory around 18?
A. As a group ---
Q. Sure.
A. --- yes.
Q. As a group?
A. I think so.
Q. Okay.
A. Yeah.
Q. And let's mark that next dot right there as 19.
(Witness complies.)
And did you have any other names for that pack or pair?
A. For 19?

Q. Yes.

A. I think that was Swindell. Yes, that is usually Swindell.

Q. And approximately what dates were there a pack or a pair of wolves holding territory or using territory?

A. When we first saw that probably in the early 2000s. And that -- I think we saw wolves as a group use that area through -- it was after 2005, sometime in the 2000s.

Q. So a pack was still using the area around 2005?

A. I believe so. But I think it was after that -- sometime after that.

Q. Sometime after that a pack was no longer using that area?

A. Yeah.

Q. Can you go ahead and mark the next dot as 20, near Lake Mattamuskeet.

(Witness complies.)

And for sticker number 20, during what dates was there a pack or pair of wolves holding territory?

A. I think we first saw a pair there in the -- it is probably the mid-'90s -- mid to late '90s, I believe. And again, that has -- it might have been in that group. We have seen a number of different groups over the years

use that area. I am trying -- I don't remember. I can't recall when last we had wolves there, though.

Q. Okay.

A. It was probably mid to later 2000s.

Q. So from the 1990s until the mid to later 2000s ---

A. (Interposing) I think so.

Q. --- wolves were pretty consistently using that property ---

A. I think so.

Q. --- or in that area? Okay. And approximately how many members were usually in that pack?

A. A pair to a few litters.

Q. So a few litters were born to a pack in that area?

A. Yes.

Q. Okay. Let's mark this one as 21.

(Witness complies.)

And before we jump to 21, did I ask about a name for 20?

A. 20 was Outfall.

Q. Okay. And for 21, was there typically a name for that pack?

A. 21 was -- probably started out as Mattamuskeet Farms. It was Mattamuskeet Ventures or Ventures.

Q. Okay. And approximately during what dates did a pack or pair of wolves hold or use territory in that area?

A. That -- that began in the early '90s.

Q. It began in the early '90s and continued for how long?

A. I believe that is still in place now. But that is -- it wasn't every year. There were -- there were some gaps in that -- those years.

Q. And usually how long were those gaps?

A. Could be a year or two. A couple of years.

Q. And usually were those gaps filled by dispersing wolves?

A. In some cases.

Q. And what about in other cases?

A. I think -- I believe we did some releases there. I can't recall if it was a captive release or if it was a wild release.

Q. And what do you mean by a wild release?

A. It is using a -- a young wolf from somewhere in the recovery area, usually dispersing age, to use that to pair with another wolf to form a pack.

Q. And when you say "used," what do you mean?

A. Did I say "use"? I forgot what ---

Q. So you said that you would use another wolf --

a wolf from another area in the recovery area ---

A. (Interposing) Yeah.

Q. --- to pair to make a pack?

A. Right.

Q. How did you get this wolf ---

A. Right.

Q. --- from elsewhere?

A. So that was -- sometimes it was an incidental capture, sometimes it was a targeted capture. And then it was -- most cases, holding in a pen in that territory, within that territory, either both animals together. Sometimes it was just one on the site, and then releasing them.

Q. And what is an incidental capture?

A. If we are trapping, say, area 3 and we happen to capture an animal that we weren't targeting, either because we -- you know, it is just an incidental capture.

Q. And for the record, could you describe what area 3 is?

A. Area 3 was Beech Ridge.

Q. Area 3 was Beech Ridge. Oh, you mean the sticker. Thank you.

A. Yeah.

Q. And then what was a targeted capture?

A. If we had a sick animal, if we had an animal

involved in a complaint, you know, or we were just targeting a group to see if there were (inaudible).

Q. So the wolves that you may have released to form a pack around 21 could have been from an incidental capture ---

A. Yes.

Q. --- or a targeted capture?

A. Yes.

Q. Let's mark this one 22.

(Witness complies.)

And did you have any names for 22?

A. That could have been Mattamuskeet Farms, Sea Blocks . Did we call it anything else? I don't know if we ever called it anything else. Maybe Hester.

Q. Okay. And during what time periods did a pack or a pair of wolves hold of use territory in that area?

A. Well, this area, again, the early '90s. And fairly consistent probably until the middle to later 2000s.

Q. And what do you mean by fairly consistent?

A. Well, this is where it is hard, because the -- you had an original group that used all of this (indicating). And then they split and you might form a group here (indicating), but not here (indicating) for a while. And then this one might move over here

(indicating). And so it is not as -- that is where it is difficult with dots.

Q. And -- sure, sure. And for the record, you were motioning between dots 21 and 22?

A. Correct.

Q. And so 21 and 22, were sometimes kind of a fluid pack or ---

A. Correct, yeah.

MS. WILLIAMS: Objection. Mischaracterizes prior testimony.

THE WITNESS: Yeah. That whole -- and it actually encompasses this (indicating) other dot.

BY MS. McGEE:

Q. You can go ahead and mark it as 23.

A. Let's mark that 23. It could have been all of this territory -- this area (indicating).

Q. Okay. So sometimes there may have been separate packs at 21, 22, and 23?

A. Yes.

Q. And at other times, there may have been fewer packs holding multiple of those ---

A. Right.

Q. --- marked areas?

A. Yes.

Q. And for number 23, did you have any other

names for that dot?

A. That was also Mattamuskeet Farms and Lux -- Sometimes it was Lux, sometimes it was Airport. Airport Road. Airport Road, I guess.

Q. And during approximately what dates was there a pack or a pair of wolves using or holding territory in that area?

A. That began in the early '90s.

Q. It began in the early '90s?

A. Yeah. So fairly consistent. We have had wolves there probably until, gosh, may even early to mid-2000s.

Q. And again, what do you mean by "fairly consistent"?

A. Usually, we had a group of wolves using that area.

Q. Were there ever any gaps?

A. Yes.

Q. And usually how long were those gaps?

A. Again, that could be several months to a year to several years.

Q. And approximately how many wolves were usually in a pack there?

A. I have seen a pair to several litters.

Q. So litters were born in that area?

A. Yes.
Q. And were litters born in 22 and 21, as well?
A. Yes, to 21. And I believe so to 22.
Q. Okay. Thank you. I know this is tedious.
A. Gosh, I am trying to remember these.
Q. Let's go to and mark that one as 24.
(Witness complies.)
And for 24, did you have any special names for that pack?
A. I think that was usually called Gator.
Q. And for number 24, during what time period did a pack or pair of wolves hold or use territory?
A. I don't know when that started. That may have predated me.
Q. Okay. So there were always wolves -- there were already wolves holding territory there when you started as a biological technician?
A. We had wolves. I don't know if we had a pack.
Q. Okay.
A. I don't remember.
Q. How long -- or how long did that pack continue, or did wolves continue to use territory there?
A. We have had -- we have had some packs use that area, again, off and on to probably maybe the early 2000s, maybe the mid-2000s.

Q. Okay. And usually, how many members were in that pack?

A. Certainly, a pair. I believe we had some litters out there. They were not as successful.

Q. Do you know they were not as successful?

A. Well, I should say -- yeah, I just can't remember if they had pairs [sic] or not. And if they did, if they survived or not. So I don't know.

Q. So when you say "pairs," you mean "litters"?

A. Or litters, yeah.

Q. Let's make this one number 25.

A. Okay.

(Witness complies.)

Q. And for number 25, did you have any special name for that pack?

A. Mill Tail.

Q. And for number 25, during what dates was a pack or pair of wolves holding or using territory?

A. That one predated me. But fairly consistent to present time.

Q. So from sometime before you started until present time, there have been -- there has been a pack of wolves there?

A. I believe so.

Q. Okay.

A. Yeah, I believe so.
Q. And usually, how many members have been in that pack?
A. We have had a pair to several -- several litters.
Q. Several litters have been born there?
A. Yes. Quite a few.
Q. And let's mark this one as number 26.
(Witness complies.)
And did you ever have any special name for number 26?
A. I believe we called that "River."
Q. River?
A. Yeah.
Q. And during what dates did a pack or pair of wolves use or hold territory there?
A. If I remember, that would be the early '90s to -- let me think. I don't recall the last time we had a group there. That may have been around the early 2000s.
Q. Okay. And usually, how many members were in that pack?
A. Yeah, there was a pair. I can't recall if they ever had a litter out there.
Q. Okay. Thank you. Now that we have walked

through all of the stickers that you previously placed on this map, are there any places that you now remember should have a sticker to denote a pack of wolves having held territory somewhere?

A. I do remember one. Right here (indicating). And ---

Q. Let's go on and number that 27.

(Witness complies.)

A. So this was -- what did we call this? Probably just called this Mattamuskeet. Or it is called Wapoppin.

Q. Wapoppin?

A. And I -- don't ask me to spell it, because I have seen it spelled too many ways. And I have spelled it a number of ways, so.

Q. Wapoppin ---

A. It is a canal that came out of the lake, there -- Wapoppin Canal.

Q. Okay. And during what dates did a pack or a pair of wolves hold territory at sticker number 27?

A. Gosh, probably the late '90s, early 2000s. This group -- or I don't think we have seen groups use that area, though, since -- I can't -- I don't remember when -- when that group stopped using that.

Q. Was it a few years?

A. They probably -- you know, it was probably the -- probably between 2005, 2010; it was in that range.

Q. And that is when a pack stopped using that area?

A. I believe so.

Q. So a pack was using that area from approximately the late '90s until sometime around 2010?

A. Yeah.

Q. And usually how many members were in that pack?

A. A pair -- I don't recall a litter out there.

Q. Okay.

MS. McGEE: Is it ---

MS. WILLIAMS: No, I was just asking whether it is a good time to take a break.

MS. McGEE: I just have maybe two or three more questions and was going to propose the same thing, if that is all right.

MS. WILLIAMS: Okay. That is fine.

BY MS. McGEE:

Q. Now that we have -- now that you have placed stickers on this map to clarify, do these stickers represent areas that a wolf pack or pair has held territory or used territory during some time while you worked with the Red Wolf Recovery Program?

A. Yes.

Q. Are there any other areas that you recollect a wolf pair or pack using territory?

A. I think this is, from what I can remember, fairly representative. Some of the -- you know, again, you can take a dot and make it much bigger, so it encompasses a larger area. Some of the centers may have been different, but that is a -- I think that is a fairly good representation.

Q. And you mentioned with some of these dots, there was some fluidity or exchange of animals between different packs or different locations; is that right?

A. Yes.

MS. WILLIAMS: Objection. Mischaracterizes prior testimony.

BY MS. McGEE:

Q. And I think, in particular, we were discussing 21, 22, and 23, that sometimes the areas held by wolves and those packs overlapped or changed over time; is that right?

MS. WILLIAMS: Objection. Mischaracterizes prior testimony.

THE WITNESS: Yeah. We have seen wolves use the entire area. We have seen it split and use parts of those areas. But that exists in other areas all

through this map.

BY MS. McGEE:

Q. So are there other areas where we have marked separate stickers for separate packs, where sometimes those packs overlapped or, during different times, their territories encompassed other packs?

A. I wouldn't -- I don't -- I -- I wouldn't say they encompassed other packs, but it could encompass a territory that may have been previously used by a different pack.

Q. Are there any particular areas on the map that you recollect that occurring?

A. Some between this area 16, 17, and 18, we have seen that. 4 and 5. Probably, it is a little bit 8 and 9, and 13, 25 and 26. That is probably it.

Q. And with 13, where -- which other stickers did it touch or encounter?

A. 12 or 9.

Q. 12 or 9? Okay.

MS. McGEE: It is about 12:07. Seems like this could be a good time to take a break for lunch.

THE WITNESS: Okay.

(DEPOSITION WAS RECESSED AT 12:06 P.M. TO RECONVENE AT 1:30 P.M. THIS SAME DAY.)

THE WITNESS: Not -- not necessarily.

BY MS. McGEE:

Q. So what was the purpose of sterilizing coyotes?

A. That was to prevent hybridization between the two species.

Q. And did preventing hybridization between the two species help to achieve recovery of the red wolf in the wild?

A. Yes.

Q. How so?

A. Well, I am trying to think of the best way to -- I think without the ability to sterilize coyotes and prevent hybridization, until there was a core population in place, we just -- you ended up with a diluted population.

Q. Did capturing and collaring, either with radio collars or GPS collars, contribute to recovery of the red wolf in the wild?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: Can you clarify in what form?

BY MS. McGEE:

Q. Yes. Did capturing and collaring red wolves in the wild help to increase the wild population of red wolves?

identified on this map, what are some of the potential causes that those packs would disband or no longer hold territory in the identified locations?

A. To me, the primary reasons for a wolf pack not necessarily holding territory, not so much that it would disband, but I think mortality was a big component with other wolf, intra-specific aggression and those kind of behaviors, age-related behaviors. It could be pack movement outside of a territory into a new one.

Q. So you are saying that the possible causes for one of these red wolf packs to no longer be holding territory would be mortality, intragression, possible age-related factors, pack movement. Anything else?

A. Not at this time.

Q. And what would be the causes of mortality?

A. Causes of mortality could include disease or health-related issues. It could include management related issues, it could be gunshots, it could be vehicle strike. I have seen wolves drown, intraspecific aggression. Did I leave anything out? That is all I can come up with right now.

Q. So looking at sticker number 1 ---

A. Uh-huh.

Q. --- is that pack still in the landscape currently?

A. Not that I am aware of.

Q. Could you take a black marker and just put a cross over that -- an X?

(Witness complies.)

Thank you. And do you know why that pack is no longer there?

MS. WILLIAMS: Objection. Mischaracterizes prior testimony.

THE WITNESS: I can't recall what happened with that pack.

BY MS. McGEE:

Q. Do you know if it was a mortality or a health or disease issue, age-related?

A. I can't remember. And I think I -- there was one other, just to clarify earlier.

Q. Yes.

A. I think in some of these cases, it was -- and for tracking a pack, because of radio-collars and a radio collar fails, it is simply we lost contact. So I -- I don't remember if this was a mortality or lost contact with the wolf. I don't remember.

Q. And do you remember around when you no longer were tracking that pack?

A. No.

Q. Okay. So same question with number 2. Is

that pack currently still holding territory there, or is a pack holding territory there?

A. Not that I am aware of.

Q. Okay. Can you please put an X over that?

(Witness complies.)

And do you know why that pack or a pack is not holding territory any longer there?

MS. WILLIAMS: Objection. Mischaracterizes prior testimony.

THE WITNESS: I can't recall that.

BY MS. McGEE:

Q. Okay. Don't know if it was a mortality issue or health?

A. Yeah. It was -- yeah. It was too many animals.

Q. Sure.

A. It was too many.

Q. And can we -- can you proceed through, in numerical order, each of the stickers, and telling me whether the pack is still there? So with number 3, is that pack still there?

A. My -- I think it is.

Q. You think it is?

A. And I think that is -- will be the case for any that I think, because -- just because I am not part

of that -- I am not in that body of information, I guess.

Q. Sure.

A. So 3, I believe is.

Q. Okay. Any idea how many animals are in it right now?

A. Other than the pair, that is all. That is all I know.

Q. And how about number 4?

A. 4, no.

Q. Okay. Thank you. And so you just placed an X on number 4.

A. 5, I am not -- 5, I am not sure.

Q. I am going to pause right there. Do you know if 4 -- why the pack is no longer there, what caused the pack to no longer be holding territory?

A. No. I just -- I don't remember for certain.

Q. Don't remember if it was a mortality issue or ---

A. No.

Q. Okay. And do you know approximately when that pack stopped holding territory there?

A. No. That was -- not specifically, no.

Q. And then number 5. Sorry. You had started to say number 5 you believe is still there?

A. Yeah. 5, I don't know.

Q. Don't know?
A. I really don't know, no.
Q. Could you put a question mark on 5?
A. Yeah.
(Witness complies.).
Q. Thank you. And number 6? Is number 6 still on the landscape?
A. 6? No.
Q. Could you please place a ---
A. (Interposing) Not -- and -- not the packs that I know of that were there when I left.
Q. When you left in 2015?
A. Just to clarify these. Right.
Q. Sure.
A. So there could be a pack there now that I am not aware of.
Q. That is fine. So for all of these questions, it is to the best of your knowledge. And it sounds like the best of your knowledge is pretty much around 2015 ---
A. Correct.
Q. --- when you left?
A. Right.
Q. Even though you still have some involvement with the ---
A. (Interposing) Correct.

Q. --- Red Wolf Recovery Program?

A. Correct. Yes, yes.

Q. But you don't regularly receive information about pack dynamics, pack details?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: Could you be specific?

BY MS. McGEE:

Q. So do you receive any sort of information from the Red Wolf Recovery Program about packs on the landscape currently?

A. Not regularly.

Q. Not regularly?

A. No.

Q. But sometimes?

A. Yeah, sometimes.

Q. Okay. Go ahead with number 6.

A. So 6, no.

MS. WILLIAMS: I am sorry. I am going to object. Can you renew your questions for each one, so that the record is clear?

MS. McGEE: Absolutely.

MS. WILLIAMS: Thank you.

BY MS. McGEE:

Q. So for number 6, is that pack still on the landscape?

A. No.

Q. So please place an X there.

(Witness complies.)

And do you know what caused that pack to no longer exist there?

A. That was -- no. if I remember correctly, we had a mortality. We also lost contact with some individuals.

Q. What kind of mortality?

A. I don't remember for certain. Yeah, that one I don't remember. That was so long ago.

Q. Do you know if it was an anthropogenically caused mortality?

A. I don't recall.

Q. And you said you lost contact with some individuals. Do you mean wolves or people?

A. Yes, wolves. Yes.

Q. Okay. Just to clarify.

A. Yes.

Q. For number 7, is that pack still on the landscape currently?

A. No.

Q. Please place an X on that one, as well.

(Witness complies.)

And do you know when that pack ceased to be

holding territory there?

A. This was -- I am trying to remember what -- what we had mentioned earlier on some of these. This might have been in the mid to late '90s. Yeah.

Q. Do you know what the cause was? Was it a mortality issue?

A. This, I believe -- I believe it was mortality related to disease.

Q. Do you know if the disease killed off one member of the pack or multiple members?

A. Multiple.

Q. Multiple?

A. Yeah.

Q. And do you know approximately when that happened?

A. Best I can recall is mid to late '90s.

Q. With number 8, is that pack still currently on the landscape, to the best of your knowledge?

A. No.

Q. Please place an X there.

(Witness complies.)

And do you know what caused that pack to no longer hold territory there?

A. That has been a multitude. We have had mortalities, we have had lost contact issues. I think

those are primary.

Q. What kind of mortalities?

A. We have had gun shots. I think we have had trap related -- private trap related. I want to say age-related, but I can't remember if there was something else. I can't ---

Q. Sure.

A. Yeah, I can't remember.

Q. And about how many mortalities have occurred there?

A. I can't even guess. I think that is a lot of those. Yeah.

Q. And when you say lost contact, that means that the radio collar went off the air?

A. Correct.

Q. And off the air meaning that it quit transmitting?

A. Well, it means we can't detect a signal.

Q. When that happens, what sort of investigation do you do to try and find the carcass or the animal?

A. Nothing, really, to try and find the animal. No.

Q. Do you try to retrieve the collar?

A. Well, if the collar is not transmitting, no. there is nothing to retrieve. I think it is more of a

wide search for the collar.

Q. It is a wide search for the collar?

A. For the -- yeah, to try and detect the frequency.

Q. You search for the collar, and then, if possible, search for the animal?

A. No. We really don't search for the animal, because it is -- it is a needle in a haystack.

Q. So sometimes, when a collar goes off air, do you sometimes find a carcass with the collar still on it?

A. After it has gone off the air?

Q. Uh-huh.

A. I don't know. I don't know that that has ever happened, unless it was a -- yeah, I can't recall if that had happened or not.

Q. So usually you just find the radio collar without the animal that previously wore it?

A. Well, or -- or the animal still in the radio collar.

Q. Right.

A. Yeah.

Q. So with number 9, is that pack still on the landscape, to the best of your knowledge?

MS. WILLIAMS: I have an objection. Vague -- should have made this earlier -- as to "landscape" --

"pack on the landscape."

THE WITNESS: Could you re-ask the question?

MS. WILLIAMS: And that will be maintained for all the other dots that you will be asking questions -- asking questions about.

BY MS. McGEE:

Q. Sure. So it ---

A. What was the question?

A. Is the pack -- is there still a pack at number 9?

A. Yes.

Q. And do you know how many individuals are in that pack?

A. I know of three in that pack, yes.

Q. Do you know the last time they had a litter?

A. This April.

Q. This April?

A. 2017.

Q. Great. Do you know how many pups were in that litter?

A. Well, I know a litter was seen. So let me back up just a step. So we know there were pups. I don't recall how many pups they saw in the den. I can't say for certain if those were wolf pups because we haven't tested any of them.

Q. And just to be clear, if they were not wolf pups, what might they be?
A. Could be a hybrid pup, coyote or wolf pups.
Q. And would sticker number 9, it looks like that territory -- does that territory include both private land and public land?
A. Historically it did, yes.
Q. Historically it did. Does it now?
A. I don't know.
Q. Do you know if the den site was on public land this April?
A. No.
Q. You don't know? Okay. And I am looking for -- there is number 10. Is number 10 -- is there a pack still located at number 10?
A. No.
Q. Could you place an X there?
(Witness complies.)
And when I ask if something is still on the landscape, what does that mean to you?
A. If you refer to a number?
Q. Yes.
A. Within the territory.
Q. Thank you. So with number 10, there are no longer animals within that territory. Do you know when

those animals stopped being in that territory?
A. Not specifically.
Q. Do you know what caused there to no longer be a pack within that territory?
A. I believe there was a mortality.
Q. A mortality? And do you know what the cause of the mortality would have been?
A. No, I don't -- I don't remember exactly which one that was.
Q. Do you know if it was an anthropogenic cause?
A. No. I don't -- I can't remember with certainty.
Q. Same with number 11. Is there still a pack on the landscape at number 11?
A. 11, I don't know. I am not sure.
Q. Okay. Could you put a question mark on that one?
(Witness complies.)
So with number 11 and with number 5, were there packs at those locations fairly recently -- in fairly recent history?
MS. WILLIAMS: Objection. Vague.
THE WITNESS: Could you clarify?
BY MS. McGEE:
Q. So you said you don't know if there is still a

pack at that location. Does that mean that there was a pack at those locations in recent memory?

MS. WILLIAMS: Objection. Vague.

BY MS. McGEE:

Q. Do you understand?

A. Can you specify? Well, recent as of the time when I worked there.

Q. Okay. So when you worked there, there was still a pack?

A. Or -- or had been recently.

Q. And when you say you worked there, do you mean just when you were with the Recovery Program in 2015, or when you physically went out to that site?

A. When I was with the Recovery Program.

Q. Okay. So as of 2015, there were still packs at numbers 5 and 11?

A. I believe so.

Q. Okay. Thank you. Pack number 12. Is there still a pack at that location?

A. I am not certain if there is. No, there is not.

Q. Was there still -- no, there is not?

A. No.

Q. Will you please place an X there?

(Witness complies.)

And do you know what the cause of that pack no longer being there?

A. Let's see. I know there were mortalities. I think there was a vehicle strike. Yeah.

Q. A vehicle strike? Do you know when that would have been?

A. I think that time period spread out over a few years. I don't remember exactly when that -- when that was. I think that pack -- I can't remember.

Q. And again, if at any point, you remember details about a pack we previously discussed, stop me, please, and let me know.

With pack number 13, is there still a pack at that location?

A. No.

Q. Can you please place an X on it?

(Witness complies.)

Do you know what caused the pack to no longer be at that location?

MS. WILLIAMS: I am going to object. Vague, lack of temporal orientation.

THE WITNESS: Yeah, I don't remember specifically.

BY MS. McGEE:

Q. Don't specifically remember what caused the

packs ---

A. (Interposing) What caused, right.

Q. --- to no longer be there? Okay. Do you know approximately when a pack ceased to occupy that location?

A. I want to say the mid to later -- probably after 2005, maybe around -- oh, gosh. I can't remember. I don't remember the year that was.

Q. How about pack number 14? Is there still a pack at that location?

A. No.

Q. Can you please place an X there?

(Witness complies.)

And do you know what caused the pack to no longer hold territory there?

A. Let me think which group. I can't -- I don't remember which one -- which pair that was last. Yeah, I don't remember if it was mortality or a disappearance.

Q. Disappearance? What would be a disappearance?

A. A radio collar -- lost contact.

Q. Thank you. And 15? Is that pack still on the landscape?

A. Where is 15? Oh, there it is.

Q. I do the same thing.

A. I am not sure if 15 is still there or not.

Q. Was 15 still there when you were with the program in 2015?

A. Yes, I believe so.

Q. Could you put a question mark if you are unsure now?

(Witness complies.)

And then for number 16, is there still a pack located at that sticker?

A. No.

Q. No? Can you please place an X on it.

(Witness complies.)

And do you know what caused the pack to no longer be holding territory there?

A. I think that was a lost contact with that individual.

Q. And no ideas as to what would have caused the pack to not hold territory?

A. Well, no, but -- well, can you clarify that?

Q. So do you have -- was there any suggestion as to why the pack no longer held territory at that location?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: Yeah. Not ---

BY MS. McGEE:

Q. Nothing beyond the radio collar ---

A. Right.
Q. --- not working? And when you searched for the radio collar, did you find anything to suggest what happened?
A. No.
Q. Did you personally search for the radio collar in that instance?
A. Yes. Probably, yeah.
Q. Okay. Is there still a pack located at number 17 on the map?
A. 17? No.
Q. Could you please place an X there?
(Witness complies.)
Do you know what caused a pack to no longer hold territory at that location?
A. I remember a mortality, but I don't remember what the cause was on that one -- on those.
Q. Do you remember whether ---
A. (Interposing) I think we had some age-related or health-related, also.
Q. Was there any anthropogenically caused mortality at that location?
A. Can you specify?
Q. Was there any anthropogenically caused mortality at that location that caused the pack to no

longer hold territory there?

A. I -- I don't remember.

Q. Is there still a pack located at number 18?

A. No.

Q. Could you place an X?

(Witness complies.)

Thank you. And do you recall why a pack no longer holds territory at that location?

A. I can't remember. I don't remember which one is which. Yeah.

Q. Do you remember some potential causes of pack disbandment in that general area, if not specific to that numbered sticker?

MS. WILLIAMS: Objection.

THE WITNESS: Could you repeat the question again?

BY MS. McGEE:

Q. If you don't remember a specific cause for a specific numbered pack's disbandment ---

A. Right.

Q. --- do you remember causes of pack disbandment in that general more -- or in that area more generally?

MS. WILLIAMS: Objection. Vague, "area more generally."

THE WITNESS: Not pack disbandment,

necessarily, no.

BY MS. McGEE:

Q. Do you -- is there still a pack at number 19?

A. No.

Q. Please place an X.

(Witness complies.)

Thank you. Do you know what caused there to no longer be a pack holding territory there?

A. I remember one mortality. I don't recall what happened to the others -- or the other one, if the other was health related. So they were both mortalities, I believe.

Q. Were the mortalities breeding red wolves?

A. Yes.

Q. Were there any litters left behind?

A. Not that I remember, no.

Q. With number 20, is there still a pack at that location?

A. No.

Q. Could you please place an X there?

(Witness complies.)

Do you know the cause for there no longer being a pack at that location?

A. I don't remember what, specifically. I can't remember which ones -- what happened to those.

Q. Okay. And is pack number 21 still located in that area on the map?
A. As far as I know, I believe it is.
Q. Do you know how many members are in that pack?
A. Huh-uh, no.
Q. Do you know how many members were in that pack in 2015, before you left the Red Wolf Recovery Program?
A. More than 2. That is all I can remember.
Q. Is pack number 22 still on the landscape?
A. No.
Q. Could you please place an X there?
(Witness complies.)
And do you know what caused pack number 22 to no longer hold territory there?
A. No. I don't know.
Q. Is pack number 23 still located in that general area?
A. No.
Q. Please place an X.
(Witness complies.)
Thank you. And do you know what caused that pack to no longer hold territory there?
A. I believe that was a mortality.
Q. Do you know what kind of mortality?
A. I believe gunshot.

Q. Do you know whether the gunshot individual was a breeder?

A. Yes.

Q. Male or female?

A. Male.

Q. Do you know what happened to his mate afterwards?

A. I know she was still out there in 2015.

Q. So the male was gunshot in 2015?

A. I don't remember if that was it -- or if it was that year.

Q. Okay.

A. I think that was earlier.

Q. So earlier than that? Okay. And then as of 2015, she had still not found another red wolf mate?

A. Not that ---

MS. WILLIAMS: (Interposing) Objection. Assumes facts not in evidence.

BY MS. McGEE:

Q. And is number 24 still on the landscape?

A. No.

Q. Could you please place an X there?

(Witness complies.)

Thank you. And do you know why a pack no longer holds territory there?

A. That was a mortality.
Q. Do you know what kind of mortality?
A. It was a vehicle.
Q. And was the killed individual a breeder?
A. Yes.
Q. Do you know when that happened?
A. Not specifically. Before 2015.
Q. Before 2015?
A. Yes.
Q. Was it after 2013?
A. I don't recall.
Q. And do you know what happened to the left behind mate?
A. I believe she is still there.
Q. Do you know whether she has found another mate?
A. She -- I believe she is paired with a sterile coyote.
Q. And is number 25 still on the landscape?
A. Yes.
Q. And do you know how many members are in that pack?
A. No, not specifically.
Q. Do you know how many members were in that pack in 2015, before you left the Red Wolf Recovery Program?

A. Not specifically, but it was more than a pair.
Q. So a pair -- did they have a litter?
A. Yes.
Q. Had a litter in 2015?
A. I don't remember if they had one in 2015. But I am not -- pretty sure there was more than just the pair.
Q. Okay. And is there still a pack located at number 26?
A. No.
Q. Could you please place an X there?
(Witness complies.)
Do you know what caused a pack to no longer hold territory there?
A. I think -- well, I think we had a mortality, and they saw some intraspecific aggression from a neighboring pack. I think those two factors.
Q. Do you know what kind of mortality?
A. That was a gunshot.
Q. And was the gunshot individual a breeder?
A. Yes.
Q. Male or female?
A. Male, I believe. Yes.
Q. Do you know what happened to his left behind mate?

A. I think she was pushed out by the other resident pack -- the neighbor pack.

Q. And do you know approximately when that happened, when he was -- when the male was gunshot?

A. It was the later 2000s. It was after 2010, probably.

Q. And I think we still have number 27 down there, near Lake Mattamuskeet?

A. Uh-huh.

Q. Is that pack still there?

A. I don't know.

Q. Was that pack still there in 2015, before you left the Red Wolf Recovery Program?

A. I believe so.

Q. Could you place a question mark there?

A. Yeah.

(Witness complies.)

Q. Do you remember how many members were in that pack in 2015?

A. Just the two breeders.

Q. Just the two breeders. Okay. How many wolves are there in the wild population currently?

A. I have no idea.

Q. No idea?

A. No idea.

where we had access to, for example.

Q. Who is "we"?

A. The Red Wolf Recovery Program.

Q. And who made those decisions about how to implement zone strategies?

A. Well, that would have been at the field level. Not necessarily any one person, though. I think that was a collective agreement.

Q. Who made the decision to stop sterilizing coyotes?

A. I am not sure.

Q. Did you make that decision?

A. No.

Q. Did somebody higher up in the chain of command make that decision?

A. They must have, because it wasn't people below me.

Q. And who would have been your higher up at that time?

A. Either David Rabon, Pete Benjamin, or somebody -- those were my two direct supervisors.

Q. And do you know who their supervisors were?

A. Well, Pete was David's supervisor. And Michelle Eversen was Pete's supervisor.

Q. Okay. When did pup fostering end in the Red

Wolf Recovery area?

A. I can't say for certain what that date was.

Q. Was it within the last year?

A. I think it was before then.

Q. So maybe two years ago?

A. Possibly.

Q. Two or three years ago?

A. Yes.

Q. Did you make that decision to stop doing pup fostering?

A. No.

Q. Do you know who did?

A. No.

Q. Was it someone higher up than you?

A. Yes.

Q. Do you know if it was Pete Benjamin?

A. No.

Q. Do you know if it was David Rabon?

A. I don't know for certain, no.

Q. When was a captive red wolf last released into the wild? And when I say "captive," I mean a red wolf from the captive breeding program.

A. Right, right. I don't know for certain what that last date was.

Q. Was it within the last year?

A. Probably before then.

Q. So probably maybe two years ago, three years ago?

A. Yeah.

MS. WILLIAMS: Objection. Multiple questions.

THE WITNESS: It would have likely been related to the last foster event. Yeah.

BY MS. McGEE:

Q. Did you make the decision to stop releasing wile red wolves -- or, excuse me, captive red wolves into the wild?

A. No.

Q. Who made that decision?

A. I don't know.

Q. Was that someone higher up than you?

A. Yes.

Q. Do you know if it was Pete Benjamin?

A. No.

Q. Do you know if it was Michelle Eversen?

A. No.

Q. But it was not you and it was not someone working for you?

A. Correct.

Q. When was the last time that you did ground

BY MS. McGEE:

Q. What part would you like me to clarify?

A. Could you repeat the question?

Q. Sure. Did stopping the release of wolves from the captive population into the wild population of red wolves assist with recovery of the wild red wolf population?

A. No.

Q. Did stopping sterilization of coyotes in the Red Wolf Recovery area assist with recovery of the wild red wolf population?

A. I would say no, in my opinion.

Q. Did stopping pup fostering help with recovery of the wild red wolf population?

A. No.

Q. Did stopping releasing of wolves from the captive population into the wild population harm recovery efforts for the wild red wolf population?

MS. WILLIAMS: Objection. Vague as to "harm."

THE WITNESS: Yeah. Can you specify just what you mean there?

BY MS. McGEE:

Q. Did stopping releases of wolves from the captive population into the wild population of red wolves

hinder efforts to increase the wild red wolf population?

A. Yes.

Q. Did stopping the sterilization of coyotes in the Red Wolf Recovery area harm or hinder recovery of the wild red wolf population?

MS. WILLIAMS: I am going to object again as vague. And that is a compound question.

THE WITNESS: Potentially.

BY MS. McGEE:

Q. Potentially? Did stopping pup fostering in the Red Wolf Recovery area reduce the population of the wild red wolf population?

A. Could you repeat that?

Q. Sure. I know. Did stopping the practice of pup fostering reduce the population of the red wolf population -- the wild red wolf population?

A. No.

Q. No?

A. No.

Q. Did it harm the wild red wolf population in any way?

MS. WILLIAMS: Objection. Vague as to "harm."

THE WITNESS: Yeah. Could you clarify that?

BY MS. McGEE:

Q. Did it inhibit your efforts to recover the red wolf in the wild?
A. In my opinion, it did.
Q. Did your -- did the Red Wolf Recovery Program's telemetry practices change over time?
MS. WILLIAMS: Objection. Vague, "over time."
BY MS. McGEE:
Q. So from the time you started as a biological technician until the time that you left the program, did the Red Wolf Recovery Program's telemetry practices change?
A. That is -- no, not -- not really.
Q. Did the regularity of telemetry monitoring change?
A. No.
Q. Do you still have the telemetry intern program?
A. No.
Q. No. So that did change?
A. Oh, yeah. That is true.
Q. Okay.
A. Yeah. It was a real short-lived.
Q. Sure. Do you know how long that program was in existence?

would attempt to make those captures?

A. Well, it was based on purpose for capture, potential age, weather factors.

Q. So how would the purpose of capture affect your capture attempts?

A. If we were targeting an adult wolf that wasn't part of the pack situation, we could trap that potentially earlier fall, whereas, you wouldn't in a pack situation, because you had a pup. Potentially, that would be too small for a collar.

Q. So did you never attempt to capture wolves during pup season?

A. There were times we did.

Q. And under what circumstances would you attempt during pup season to capture wolves?

A. Well, if it was, you know, depredation complaints; if -- if it didn't involve a pack with pups, it could have been.

Q. Do you know how many confirmed red wolves depredation events there have been over the course of the Red Wolf Recovery Program?

A. Confirmed depredation events? No.

Q. We are up to Exhibit 5.

(PLAINTIFFS EXHIBIT 5 WAS MARKED FOR IDENTIFICATION.)

And the Bates number for this exhibit -- Exhibit Number 5 -- start with USFWS-0011203.

A. Okay.

Q. Are you familiar with this document?

A. Vaguely. Certainly parts of it.

Q. What parts of it?

A. Lots of parts.

Q. Sure.

A. A lot of the information is familiar. And I am trying to remember how much of this I wrote or helped put together, but I can't -- can't recall.

Q. Could you generally describe for the record what this document is?

A. This was, I think, the information we were providing to a group of landowners in Hyde County related to wolf demographics and some of the -- just information on coyotes that we have, and our experience.

Q. And why were you providing this landowner with this information?

A. I believe they requested it. I believe this was a request on their part.

Q. Did this landowner have red wolves on their land?

A. Yes.

Q. And were they accepting of the red wolves on

their land?

MS. WILLIAMS: Objection. Vague.

BY MS. McGEE:

Q. Did they complain about the red wolves on their land?

A. No, no.

Q. On the third page of this document, Bates number USFWS-0011205, there are several bullet points on the top of the page?

A. Yeah.

Q. The last bullet point states that there were six depredations that were found to involve red wolves?

A. Correct.

Q. Does that seem accurate to you?

A. Yes.

Q. That sounds right?

A. Uh-huh.

Q. Do you know when this document was created?

A. This probably was -- it was '14. Yeah. This would have been 2014.

Q. Do you know if there have been any additional confirmed depredations by red wolves since this time?

A. Not that I recall.

Q. In your experience, are most complaints about depredations actually caused by red wolves?

A. Could you ask that again, please?

Q. Sure. In your experience, are most depredation complaints from within the Red Wolf Recovery area actually attributable to red wolves?

A. No.

Q. What are they usually attributable to?

A. I think this is representative, certainly. I think the most that we found were dogs, by far. And typically, the owner is a neighbor's dog. That was usually the best that we can determine.

Q. That was usually the correct source of a depredation complaint?

A. Uh-huh.

Q. And you just said "these seemed pretty accurate"?

MS. WILLIAMS: Objection. Mischaracterizes prior testimony.

BY MS. McGEE:

Q. When you said, "these seemed pretty accurate," were you referring to the bullet points ---

A. Yes.

Q. --- on USFWS-0011205?

A. Yes.

Q. Thank you. When you first started as a biological technician with the Red Wolf Recovery Program,

Q. Could you describe what this document is?
A. I think, verbatim, it is canids captured on Bee Tree farms through trapping efforts.
Q. And could you show me where Bee Tree Farms is on the map that is in Exhibit 3?
A. Well, somewhere right around in here (indicating).
Q. Okay. And for the record ---
A. (Interposing) Just -- just -- yeah.
Q. And you are marking just north of sticker number 8?
A. Correct.
Q. And that was the pack that you had previously stated was sometimes called "Tyson"?
A. Yes.
Q. Also called Bee Tree?
A. Yes.
Q. Okay. And a Mr. Jett Ferebee is the owner of Bee Tree Farms, correct?
A. I believe so.
Q. Were similar time lines of capture efforts responding to removal requests compiled for other landowners?
MS. WILLIAMS: Objection. Vague.
BY MS. McGEE:

those requests?

A. It was, I think, more in-house at the field level.

Q. In 2014?

A. Uh-huh.

Q. Were you ever directed from a higher up as to how to respond to a removal request?

A. Not in those initial -- not necessarily in those initial letters, I don't believe.

Q. But in other instances?

A. Yeah. And I don't remember what year it was. I believe it was following this, where it was -- the other idea was to provide -- I don’t know -- permission or authority under our permit -- our ability, to trap for those people to trap, themselves, or hire a trapper.

Q. And whose idea was that?

A. I don't know.

Q. Someone higher up?

A. Uh-huh.

Q. So not your idea?

A. No.

Q. But it was an idea that you implemented?

A. Yes.

Q. On somebody else's orders ---

A. Yes.

Q. --- essentially? And those trapping authorizations were given to private trappers?

A. I don't remember -- and I sent the letters out, at least some of them -- if it was to the landowner with their agent, or a trapper that would work with us or through us, or if we sent them directly to the trapper. I can't remember.

Q. I might be able to help you out.

A. But none of them were the trapper, so ---

Q. I am handing you what we will label as Exhibit 9, which has Bates number USFWS-0019930.

(PLAINTIFFS EXHIBIT 9 WAS MARKED FOR IDENTIFICATION.)

(Witness peruses document.)

A. Okay.

Q. Does this refresh your recollection?

A. Oh, absolutely.

Q. What is this document?

A. So this is a letter in 2016 to a private trapper giving authorization to trap four red wolves. I am not sure who this went to or whose property -- Tyrrell County.

Q. That is fine. Did these trappers receive any sort of training as to how to trap for red wolves?

MS. WILLIAMS: Objection, calls for

speculation.

THE WITNESS: Not by -- not by us.

BY MS. McGEE:

Q. So you did not require any particular training of these private trappers?

A. Well, not -- not training. I think those required -- yeah. So they did have to follow rules and regulations -- the State rules and regulations regarding trapping. This specified the type of traps, types of stakes, yeah.

Q. Do you know what this ---

A. (Interposing) And these were known trappers to us.

Q. They were known trappers?

A. Correct.

Q. Do you know what the State rules and regulations are as they pertain to trapping in these areas?

A. Not -- not enough to reiterate.

Q. Sure. And how was the decision made to give a trapping authorization to a particular private landowner?

A. I don't know.

Q. So you didn't make the decision on a case-by-case basis?

A. Well, could you clarify that?

Q. So when receiving a removal request, who made the decision whether to respond with a trapping authorization like that in Exhibit 9?
A. I don't know exactly whose decision it was.
Q. So you just signed the letter?
A. Right.
Q. Somebody else decided whether a trapping authorization should be given to a particular ---
A. Correct.
Q. --- private landowner?
A. Correct.
Q. Or private trapper?
A. Yeah.
Q. Could a landowner be given such a trapping authorization any time of year?
A. Not -- that is not my understanding.
Q. So what times of year would they be able to have this trapping authorization?
A. Well, we would likely have not issued it if it was too hot to trap, for example.
Q. Okay.
A. And that is probably the biggest criteria.
Q. Okay. Was there any sort of oversight of these private trappers as they trapped for red wolves under Fish and Wildlife Service's permit?

MS. WILLIAMS: Objection. Vague, as to "oversight."

THE WITNESS: Not that I am aware of.

BY MS. McGEE:

Q. So what happened when they caught a red wolf?

A. They were required ---

MS. WILLIAMS: Objection. Vague, as to "they."

BY MS. McGEE:

Q. When a private trapper caught a red wolf off of private land, what happened?

A. Well, I can't say exactly what happened.

Q. Did they call you, or how did you find out ---

A. (Interposing) That was ---

Q. --- that a red wolf was trapped?

A. Yeah, for us, it was -- it was a -- it was a phone call, yes.

Q. And then what happened?

A. And it was us, on our end, coordinating pickup of that animal.

Q. What kind of traps could the private trappers use when trapping red wolves?

A. I am sure it was the same we used or -- yeah. I mean, it doesn't specify here, so it would have been whatever was allowed under the State regs, or under our

A. And, again, that was -- really was determined -- for example, if we were trapping a piece of property, we might want to hold an animal and not release him until we were done trapping, to keep it from getting caught again, just knowing that there is an inherent risk in trapping -- to minimize that risk.

If we wanted to pair that particular wolf with another wolf in the population, to produce a pair, to make a new pack, depending on the individual animal and its age and all those conditions, that could determine how long we would hold it.

Q. Did you have the authority to make the decision to release wolves that were being held after being removed from private lands?

A. Yes.

Q. Even most recently, in your role as the supervisory wildlife biologist?

A. No.

Q. So that changed?

A. That did change.

Q. Do you know when that changed?

A. That probably changed around 2013, '14.

Q. So then ---

A. And -- yeah. I think so.

Q. So then who made that decision?

A. That came down from above me, through my chain of supervision.

Q. I am handing you what will be Exhibit Number 15, with Bates number USFWS-0011693.

(PLAINTIFFS EXHIBIT 15 WAS MARKED FOR IDENTIFICATION.)

I will give you a moment to read through it. I know it is ---

A. Yeah. This is a little bit longer.

Q. It is a hefty one.

(Witness peruses document.)

A. Yes.

Q. So do you recognize this October 28th, 2014 e-mail?

A. Yes.

Q. Who made the decision when to release these wolves mentioned in this email?

A. Somebody above me.

Q. Somebody above you. And you were told to keep holding them despite the potentially deleterious effects on the those wolves?

A. Yes.

Q. You expressed your concern to your supervisor about the effects on these wolves?

A. Uh-huh. Yes.

MS. WILLIAMS: I am going to object ---

BY MS. McGEE:

Q. (Interposing) Do you know ---

MS. WILLIAMS: --- to the characterization of this e-mail as speaking to wolves.

BY MS. McGEE:

Q. Do you know when these wolves were released?

A. I can't remember exactly when they were released.

Q. I am handing you what will be Exhibit Number 16, Bates number USFWS-0012881.

(PLAINTIFFS EXHIBIT 16 WAS MARKED FOR IDENTIFICATION.)

Do you recognize this e-mail from February 9th, 2015?

A. Yes.

Q. In the last sentence, you state that both wolves captured on this property are in a pen at Sandy Ridge, and will remain there pending a later decision on their disposition. Whose decision are you referring to?

A. That was whoever's decision came down to me.

Q. So not your decision?

A. No, no. I think that is just reflecting that somebody would make that decision.

Q. Were you concerned about these wolves'

well-being?

A. Yes.

Q. Why?

A. Just the -- I think it is more just the time period for a wild wolf to be held, and the effect on that wolf being incorporated back into the population.

Q. So what effect does being held for a prolonged time have on a wolf being incorporated back into the wild population?

A. Possibly a tolerance to people -- human tolerance, which could create a lot of unforseen issues. Another may be pack acceptance issue. Those are the two that come to mind.

Q. Would wolves that were removed from private lands typically be released back near those same private lands?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: That kind of depends, I think, on the individual case.

BY MS. McGEE:

Q. How did you decide where to release a wolf that had been removed from private lands?

A. Historically, it was to the nearest Refuge.

Q. And did you make that decision, historically?

A. In some cases, yes.

Q. In these cases, in Exhibit 16 and Exhibit 15, did you determine where to release the wolves in question?

A. No, I don't believe so.

Q. Did someone else make that decision?

A. Yes.

Q. Was that someone else higher up in the chain of command than you?

A. It would have been. It wouldn’t have been someone below me.

Q. Sure. And to briefly revisit Exhibit 15 ---

A. Uh-huh.

Q. --- I believe I misspoke when I referred to “wolves,” in the multiple. So looking at this exhibit again, you were concerned about the wolf being held, as mentioned in Exhibit 15; is that correct?

A. Gosh. I think there were two involved in this ---

Q. There were?

A. --- document. So what was your question?

Q. Looking at Exhibit 15 ---

A. Uh-huh.

Q. --- you specifically mentioned, after the first set of bullet points, "In light of these conditions, I would like to release this wolf as soon as

possible, to avoid creating human tolerance and so it is accepted back into the pack structure."

A. Yes.

Q. So you were concerned about holding this wolf for a prolonged period of time?

A. Yes.

Q. And how long was that wolf being held?

A. I don't remember exactly how long it was held.

Q. Was it approaching a two-month period?

(Witness peruses document.)

A. Yeah. There it is. Yes. Yeah.

Q. Prior to the time frame of this e-mail in October of 2014, how long did you typically hold wolves that were removed from private lands?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: So, really, again, it depends on all those factors of age and location and time of year and other management needs. That could really depend.

BY MS. McGEE:

Q. But in the past, you made that call, how long to ---

A. (Interposing) Sometimes.

MS. WILLIAMS: Objection.

BY MS. McGEE:

Q. --- hold them, usually?

MS. WILLIAMS: Objection. Vague.

BY MS. McGEE:

Q. I am handing you what will be Exhibit 17, with Bates number USFWS-0013037.

(PLAINTIFFS EXHIBIT 17 WAS MARKED FOR IDENTIFICATION.)

(Witness peruses document.)

Do you recognize this March 18th, 2015 e-mail?

A. Yes.

Q. In this e-mail, you state, approximately three lines up from the end of the e-mail: "The question we have is whether these two wolves can be released, per our current rule"?

A. Correct.

Q. What did you mean by that?

A. I think that is just -- that is referring to the -- and I don't remember it verbatim -- the section of the rule that describes scenarios where wolves are captured, barring any health or behavioral component, be released -- I can't remember if it said, "As soon as possible," or to that effect.

Q. So you were wondering whether these wolves could be released as soon as possible ---

A. Yes.

Q. --- in essence? And one of the wolves

mentioned in Exhibit 17 was the same wolf you expressed concern about in that February 9th, 2015 e-mail marked as Exhibit 16; is that right?

A. I can't -- I don't know. I don't -- I don't know if those are the same one or not.

(Witness peruses documents.)

It could be, but I don't know for certain.

Q. So in the ---

A. (Interposing) Yeah, I am not sure.

Q. And in Exhibit 17, one of the wolves you refer to as having been trapped on February 9th?

A. Uh-huh.

Q. And Exhibit 16 is talking about a collared wolf that was captured on February 9th; is that right?

A. Yes.

Q. So that wolf had been held for almost a month and a half at the point of Exhibit 17 -- the March 18th ---

A. (Interposing) Yes.

Q. --- e-mail?

MS. WILLIAMS: Objection.

BY MS. McGEE:

Q. Do you know when these wolves were released?

A. I think one wolf was released, but I don't remember the date. I think the other wolf was kept in

the captive program.

Q. Why was the other wolf kept in the captive program?

A. If I -- if this is the wolf that I recall correctly, we did have a wolf that was held for an extended period of time that we felt had been too long, and we may have created an issue with tolerance, a wolf that was captive born that could be incorporated into the captive program that I believe had genetics that were favorable.

Q. So this was a wolf that had been in the wild and then was removed from private lands?

A. Yes.

Q. And then after being held for a long time, you were concerned it was too tolerant of humans to release back into the wild?

A. Yes.

Q. And do you know who made the decision when and where to release these?

A. No.

Q. Do you know where the -- the one wolf that was released, where they were released?

A. I don't remember where that was released. Yeah, I can't remember where that one was released.

Q. Under what circumstances would you or the Red

where that was caught, where the nearest Refuge lands were.

Q. And what usually happened when you released a wolf onto Refuge lands that had previously not had an established home range on Refuge lands?

A. In some cases, they would return immediately to where they were captured. And other times, they wouldn't. I think more times than not, they returned.

Q. And when they returned, were they at greater risk to vehicle strikes if they were having to traverse great distances?

A. Potentially.

Q. Was it more stressful for the animal to be released away from their home range?

A. Well, if I could get into the mind of a wolf, the things I would ask.

Q. Sure.

A. I think it is safe to say taking something out of the comfort of its own home or family structure or whatever you want to call it, would -- would be a challenge.

Q. I am handing you what will be marked as Exhibit 18, with Bates number 0008209 -- I am sorry, USFWS-0008209.

(PLAINTIFFS EXHIBIT 18 WAS

MARKED FOR IDENTIFICATION.)

A. This is a fun one.

(Witness peruses document.)

Okay.

Q. Do you recognize this ---

A. Yes.

Q. --- April 26th, 2013 e-mail?

A. Oh, yeah.

Q. Why were you frustrated about the hybrid litter?

MS. WILLIAMS: Objection. Mischaracterizes the e-mail. Also, vague.

THE WITNESS: Could you repeat that?

BY MS. McGEE:

Q. So in this e-mail ---

A. Uh-huh.

Q. --- you are discussing the results of a litter that came back hybrid, correct?

A. Yes.

Q. Were you frustrated by those results?

A. Yes.

Q. And why were you frustrated with that situation?

A. Could you be specific?

Q. Why were you frustrated that those pups came

back hybrid?

A. Well, we had three litters that came hybrid -- came back hybrid, which is always -- frustration. In particular, in this case, it was -- I think this was potentially -- this is where we don't know the details -- potentially, related to a landowner request for removal.

Q. From?

A. This one would have been the one at Bee Tree, where we lost the breeding male. I think that is the one where the breeding male disappeared during breeding season.

Q. And when you say disappeared, you mean the collar went off the air?

A. Right. We lost contact, yes.

Q. And this was from -- this first hybrid litter that you are discussing was on Tyson or Bee Tree Farms, correct?

A. Uh-huh. Yes.

Q. And you received a lot of removal requests from that landowner, correct?

A. Yes.

Q. So removing wolves sometimes contributed to hybridization with coyotes -- between red wolves and coyotes?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: There was that -- that potential existed.

BY MS. McGEE:

Q. Isn't that what happened in this case?

A. Well, potentially, because we don't know what happened to the male. We just knew he disappeared, you know.

Q. Was there a stable pack on Bee Tree at that time?

A. Yes.

Q. Was the landowner requesting removal of wolves regularly during that time, 2013?

MS. WILLIAMS: Objection. Vague, "regularly."

THE WITNESS: Yeah. And this one, I think I could go back ---

BY MS. McGEE:

Q. I was going to say, if you look at ---

A. --- to the documents.

Q. --- Exhibit 8 ---

A. Yeah.

Q. --- that might help.

A. Yeah. This was April 2013.

Q. So does Exhibit 8 show two -- does Exhibit 8 show three red wolves were removed between February 2012

A. Uh-huh.

Q. Surviving beyond -- or up into breeding age?

A. Yeah. I mean, for any population to continue, it has to -- you know, it has to reach a certain age and reproduce and continue that cycle. It doesn't -- I mean, the population has to increase, but when you start with zero, it can only go in one direction, typically.

Q. Sure. And what sort of actions that you previously discussed helped to achieve those two components?

MS. WILLIAMS: Objection. Vague.

BY MS. McGEE:

Q. How did your work with the Red Wolf Recovery Program help to maintain an adequate number of breeding pairs and help red wolves survive?

A. In some ways, it did very little in terms of survival, potentially. We just monitored it and watched it happen. But in some ways, I think the ability, you know, to have some of those tools to monitor, to release captive wolves in the population, to prevent hybridization, were tools that were helpful.

Q. And those helped with the population growing over time?

A. Yeah. Maybe growing, or at least maintaining some stability.

of value to recovery of the red wolf?

MS. WILLIAMS: Okay. So objection, confusing. Vague as to "value."

THE WITNESS: Yeah, I am not sure how to answer that.

BY MS. McGEE:

Q. Do wild-born wolves contribute to recovery of the wild red wolf population.

MS. WILLIAMS: Objection. Vague as to contribute.

THE WITNESS: Yes. I mean -- yeah.

BY MS. McGEE:

Q. And do wild red wolves have certain characteristics that are different from captive born red wolves?

MS. WILLIAMS: Objection. Vague as to characteristics.

THE WITNESS: And it is -- potentially. You could have, for example, a one or two week old pup, not necessarily, which is a -- one reason they are used, that is helpful. You know, adults might be a different story.

BY MS. McGEE:

Q. So comparing a wild-born adult wolf to a captive-born adult wolf, are there differences between those two wolves?

A. There are differences in terms of behavioral, typically, human tolerance, I would say. You know, a wild wolf knows how to do things automatically. A captive wolf might take a little bit longer.

Q. So a wild-born red wolf will have certain experiences and a lack of human tolerance that makes it better suited to surviving in the wild?

MS. WILLIAMS: Objection. Mischaracterizes prior testimony.

THE WITNESS: Yeah, potentially. But that is a case by case basis.

BY MS. McGEE:

Q. Sure.

A. Yeah.

Q. Sure. Was there ever an outreach coordinator with the Red Wolf Recovery Program?

A. Yes.

Q. When was that?

A. Good question. I think that was in the late '90s, I think was our first one, that position started.

Q. Do you know that person's name?

A. That was probably Jennifer Gilbreath.

Q. And did someone fill that position after Jennifer Gilbreath?

A. Yes. I don't remember that person's name. We

previous testimony.

BY MS. WILLIAMS:

Q. Can you please repeat your answer?

A. Not full time. Not -- not under my job description, correct.

MS. WILLIAMS: Okay. I have no further questions.

MS. McGEE: We have a few recross.

R E D I R E C T E X A M I N A T I O N 6:52 P.M.

BY MS. McGEE:

Q. First of all, with regards to this map, the red dots where you have not placed a cross, what do those mean to you?

A. The ones without a question mark are those that I understand are still a current pack in place.

Q. And how many of those dots are there on this map?

A. Four.

Q. And previously, you testified that there were two three breeding pairs or packs that remain; is that right?

A. Uh-huh. Correct.

Q. So where are those two to three breeding pairs or packs in relation to the red dots on the map?

A. Yeah. I believe that is 25, 9, and 3.

Q. 25 and 9 and ---

A. And 3.

Q. 3? So what about 21?

A. Yeah, 21 -- so pack -- pack -- it kind of gets at the definition of a pack, I suppose, where we have or they suspect that there is a breeding pair and other members of that group intact now. One could have an old radio collar, it has lost contact, but believed to still be there. Other pack members are still there. So that is still referred to as a pack.

Q. Okay.

A. But not necessarily with a known breeder.

Q. Okay. So for the sticker numbered 21 on this map in Exhibit 3, there is not a known breeding pair, to the best of your knowledge?

A. To my knowledge, correct.

Q. But there is still some semblance of a pack?

A. Yes.

Q. What does it mean to disperse, in the context of red wolves?

A. Dispersal is usually a -- how would you define dispersal? It is such an obvious -- or -- this is usually seen in younger wolves that are part of a pack that usually around, I think, on average of 18 months will leave that pack structure or either -- whether they

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NAME: ARTHUR BRUCE BEYER   DATE: MAY 30, 2017   CASE NO.: 2:15-CV-42-BO

Page #	Line #	How You Wish The Line or Phrase to Read	Reason for Change
10	11	Change “Jim” to “Jeremy”	Incorrect name
16	25	Change “cold” to “leg-hold”	Incorrect term
19	5	Change “old” to “leg-hold”	Incorrect term
26	1	Change “didn’t” to “did”	Incorrect term
49	20	Change “find” to “fine”	Incorrect term
49	17	Change “Mr. Weaver” to “Ms. Williams”	Incorrect name
49	25	Change “Mr. Weaver” to “Ms. Williams”	Incorrect name
54	4	Change “provision” to “privilege”	Incorrect term
69	18	Change “is a little soft” to “sloughed off”	Incorrect term
74	21	Change “just” to “just to”	Incorrect term
76	7	Change “manager” to “management”	Incorrect term
100	2	Change “nests” to “pairs”	Incorrect term
102	18	Change “paired several” to “paired with several”	Incorrect term
102	23	Change “seizing” to “using”	Incorrect term
154	21	Change “orientation to “limitation”	Incorrect term
170	1	Change “does not represent” to “that it does not represent”	Incorrect term
173	23	Change “I” to “it”	Incorrect term
186	9	Change “the owner is a neighbor’s dog” to “it’s the owner’s or a neighbor’s dog”	Incorrect term
186	10	Change “can” to “could”	Incorrect term
241	12	Change “dispersant” to “dispersing”	Incorrect term
245	3	Change “frustration” to “frustrating”	Incorrect term
267	22	Change “a lot to contribute” to “a lot that contributed”	Incorrect term
269	3	Change “Yes, I think we have” to “Yes, I think because we have captive wolves.”	Clarifying response
273	20-21	Remove “but yeah.”	Grammar
290	3	Change “track off the site” to “trap off site”	Incorrect term
294	1	Change “what would be” to “would be”	Incorrect term
294	8	Change “yeah” to “no”	Incorrect response
294	11, 12, 21	Change “guidelines” to “ ‘guidelines’ ”	Missing punctuation
299	20	Change “would have” to “would have had”	Grammar
301	20	Change “two three” to “two to three”	Incorrect term
306	1	Change “huh-uh” to “No”	Clarifying response
306	12	Change “it could” to “we could”	Incorrect term
306	13	Change “just not necessarily why” to “just not told necessarily why”	Incorrect term
308	7	Change “guidelines” to “ ‘guidelines’ ”	Missing punctuation.
117	2	Change “inaudible” to “uncollared wolves”	Clarifying Response

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF NORTH CAROLINA
NORTHERN DIVISION

RED WOLF COALITION, DEFENDERS OF WILDLIFE, AND ANIMAL WELFARE INSTITUTE, PLAINTIFFS,	)	
V.	)	NO. 2:15-CV-42-BO
THE UNITED STATES FISH AND WILDLIFE SERVICE, DAN ASHE, IN HIS OFFICIAL CAPACITY AS THE DIRECTOR OF THE UNITED STATES FISH AND WILDLIFE SERVICE; CYNTHIA K. DOHNER, IN HER OFFICIAL CAPACITY AS REGIONAL DIRECTOR OF THE UNITED STATES FISH AND WILDLIFE SERVICE SOUTHEAST REGION, DEFENDANTS.	)	

DEPOSITION OF LEOPOLDO NARCISO MIRANDA

THURSDAY, JUNE 1, 2017

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9:03 A.M.

VOLUME 1

PAGES 1 THROUGH 246

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T A B L E O F C O N T E N T S

EXHIBITS (CONT'D)

EXHIBITS (CONT'D)

anymore -- it is Fisheries and Habitat Conservation. And then, it became just Fisheries. And so without moving, I changed programs a couple of times.

Q. So let's get into the details of the Ecological Services stuff. You said it didn't exist in D.C., it did exist in Puerto Rico. Do you know where that program started or how it evolved?

A. Well, the program has always been there, but in D.C., at the time, Endangered Species was by itself. And then the Habitat Conservation side, which is what I mentioned earlier, like the Partners in Coastal Program, the Clean Water Act, 404 stuff -- all of those programs were not with Endangered Species. And then they split that and combined them and finally got Ecological Services.

It is a mess. But in the Regions, Ecological Services, as a program, has always been there.

Q. You mentioned your position in D.C. was in Fisheries and Habitat, then it became Fisheries?

A. Yes.

Q. Was that position very Fisheries focused?

A. Not really. It was all fish and wildlife issues. It was, for management purposes, under the Fisheries Assistant Director.

Q. Okay. And then tell me about coming to

Atlanta?

A. So I came to Atlanta, I believe, 2011. I came first -- my position was Assistant Regional Director for Ecological Services. So I came -- I was still in Chesapeake Bay. And I did a detail, because the person that was here before me got another job, so the position was vacant. And I came just to cover for a little while, and applied for the job and got the job a couple of months later.

So the detail was in 2010. And I got the job in 2011. So, yes, that is how I came in. I applied for the job and got it.

Q. And how has your work shifted over time?

A. What do you mean?

Q. Within the Fish and Wildlife Service.

A. Well, it is -- you know, as I mentioned, I have had many positions, different Regions, National Office and all of that. So very diverse. And I love every single minute of it.

Q. Do you spend a lot of time traveling?

A. Yes.

Q. Yes? Where do you travel to?

A. With -- because of my job, most of my trips are, you know, within the Southeast Region.

Q. Tell me what is within the Southeast Region?

A. So the Southeast Region for the Official Wildlife Service is 10 states. So that goes from here -- from North Carolina, you go down all the way to Louisiana and you go north from Kentucky to Florida -- you are picturing that -- and then Puerto Rico and U.S. Virgin Islands. So it 12 different jurisdictions.

Q. How many Regions are there of Fish and Wildlife Service, nationwide?

A. I think it is nine. Eight regions and headquarters. That is basically another region.

Q. How does the Southeast Region compare in terms of geographic size?

A. In terms of size, we are one of the largest. Also, I believe that, besides the Northeast Region -- which has probably a couple of more states, because there is a bunch of small states in New England -- in terms of states, I think we are also, if not the first one, the second largest one in terms of jurisdictions that we deal with.

In terms of geography, we are right there one of the largest ones. Maybe the midwest, with all of the plains and all of that, they are just larger. And then Alaska is it's own region, and that one is half of the lower 48.

Q. How does the Southeast Region compare in terms

THE WITNESS: Can you repeat?

BY MS. WEAVER:

Q. Yes. My question was if you can describe your current responsibilities in your current position?

A. Yes. As Assistant Regional Director for Ecological Services, my responsibilities is to focus on managing everything under -- all the programs within the Endangered Species Act. So I manage the policy side, the budgets and personnel -- you know, everything in terms of program management for the Endangered Species Act as well as -- as I mentioned, the other two programs: Partners for Fish and Wildlife, Coastal Program and all of the environmental compliance -- non-ESA environmental compliance, like the Clean Water Act, Fish and Wildlife Coordination Act, things like that.

So I manage all of those programs within Ecological Services. And the other big part of my job is then managing the field offices. So each state has at least one office. Other states -- some states have multiple offices, like Florida. We have four offices down there.

So I supervise, through my chain of command, those supervisors. I don't supervise them directly. I have Area Supervisors, where we divide the Region in a couple of areas. So that -- in general terms, that is my

MR. HESSLER: Objection, vague, "work."

THE WITNESS: General management of -- you know, it is under my jurisdiction -- my management purview, so ---

BY MS. WEAVER:

Q. Who were you managing on your staff in 2011 with regard to red wolves?

A. When, in ---

Q. 2011, when you began?

MR. HESSLER: Objection. Assumes facts not in evidence.

THE WITNESS: Can you be more specific?

BY MS. WEAVER:

Q. You testified that you began working with the field office in 2011, and that you began working on red wolves when you began working with the field office. What was the nature of that work when you began working with the field office?

A. Well, as a, you know, second and third line supervisor. That was the first interaction. At that time, the red wolf program itself -- I was managing the budgets, but it wasn't under my direct line of supervision.

Q. When did the Red Wolf Program come under your direct line of supervision?

A. I may be mistaken with the dates, but it was around 2013.

Q. 2013? Who did you take over supervision of the Red Wolf Program from?

A. I personally didn't take over. So what do you mean?

Q. Who was in charge of supervising the Red Wolf Program before you?

A. So the Red Wolf Program at the time was supervised by the National Wildlife Refuge System, not Ecological Services.

Q. Do you know the individual who was in charge of supervising the Red Wolf Program prior to you?

A. I -- I am not completely clear on the chain of command, but Mike Bryant was the complex manager, and he supervised David Rabon, who was the coordinator at the time.

Q. When you took over supervision of the program in 2013, who did you speak to about that?

MR. HESSLER: Objection, vague, "that."

BY MS. WEAVER:

Q. About the operations of the Red Wolf Program?

A. Can you repeat?

Q. When you took over the program in 2013, who did you speak to about the Red Wolf Recovery Program?

A. Many people, from the field all the way up to the management within my region -- my boss, human resources, budget people.

Q. Did you speak to Mike Bryant about the Red Wolf Recovery Program?

MR. HESSLER: Objection, vague, no temporal element.

BY MS. WEAVER:

Q. When you took over the program in 2013 did you speak to Mike Bryant about the Red Wolf Recovery Program?

A. I believe that he was in a couple of the conference calls that I had.

Q. Did you speak to David Rabon about the Red Wolf Recovery Program when you took it over in 2013?

A. Yes.

Q. Who else did you speak to in North Carolina about the Red Wolf Recovery Program ---

MR. HESSLER: Objection ---

BY MS. WEAVER:

Q. --- in 2013?

A. All the staff and the stakeholders. Many people.

Q. Do you know who made the decision to move the Red Wolf Program from Refuges to Ecological Services?

A. Yes.

Q. Who made that decision?

A. I -- I made the decision together with David Viker. He is my counterpart for National Wildlife Refuge System, in coordination with my boss and the field -- coordination with the field office and Pete Benjamin. So we moved that under Ecological Services.

Q. Why did you make that decision?

A. Red wolf, at the time, is the only program -- Endangered Species program that was being managed by a different organization or program within the Agency. In this case National Wildlife Refuge System. And to make it equal to, for example, the Puerto Rican Parrot -- that is a single species program -- just to make it the same, we made that move.

Q. When you say "make it equal," what do you mean by that?

A. In terms of management, you know, having the -- all of the Endangered Species Recovery programs under one management umbrella instead of multiple, meaning Ecological Services.

Q. What do you see as the benefit of that?

A. Better coordination, better communication, efficiencies in terms of management.

Q. Were there budgetary reasons to make the move?

A. Not really, because the budget hasn't changed.

Q. I believe you said that you and David Viker made the decision to make the move, along with your boss?

A. I think, actually ---

Q. Apologies. Let me rephrase. I believe you said that you and David Viker, along with your boss, made the decision to move Refuges -- I am sorry, to move the Red Wolf Program from Refuges to Ecological Services; is that correct?

MR. HESSLER: Objection. Mis-characterizes prior testimony.

THE WITNESS: So for clarification, what I said is that David Viker, as my counterpart -- another Assistant Regional Director -- and I, we met and decided that the program was going to be better managed under Ecological Services, in coordination with my superiors, because we keep the entire chain of command informed of the move and potential management changes.

BY MS. WEAVER:

Q. When you mentioned better coordination as being one of the reasons for that move, better coordination with who?

A. Better coordination in terms of the management, in general -- supervisory, in terms of the resource of the budget. Instead of going from one program to another program then to the office, now it

goes directly to the field office. That kind of things.

Q. Is there a different mission between Ecological Services and The National Wildlife Refuge Program?

A. No. We are all under the same Fish and Wildlife Service mission.

Q. Has that move worked out well?

A. In my opinion, yes.

Q. How has it improved things?

A. Well, one of the biggest improvements is the more efficient way of sending funds, for example. The field office now, it goes straight from Atlanta to the Red Wolf Recovery Program office. Before, it had at least two stops or three stops internally.

Q. Where is the field office that manages the red wolf program within Ecological Services?

A. Can you ---

Q. Where is the field office that manages the Red Wolf Recovery program under Ecological Services?

A. It is -- the Red Wolf Recovery Program office is in Manteo at the Refuge. It is co-located with the Refuge, yes.

Q. So -- and the Refuge office is in the same place?

A. Correct. It is in the same building.

"documents."

THE WITNESS: What kind of documents -- scientific, compliance documents?

BY MS. WEAVER:

Q. How much time did you spend getting up to -- how much time did you spend learning about the Red Wolf Program when you took over its supervision in 2013?

A. Wow. That is really hard to say, you know. I met multiple times with staff, and briefings and things like that. But estimating an amount of time, that is impossible for me.

Q. You said, I believe, that you spoke with Mike Bryant; you said you spoke with the staff, David Rabon. Who are the other members of the Fish and Wildlife Service staff that you spoke to about red wolves in 2013?

A. You know, I might be, you know, I might be missing people, because it was some time ago, but I will say some of the staff, Art Beyer. I don't remember if Rebecca was there at the time or not. Pete Benjamin.

What is his name from Pocosin Lakes? The manager. I can see him, with a beard. The Manager for Pocosin Lakes -- Howard Phillips -- and folks like that.

Q. You mentioned David Rabon, speaking with him. He was the previous Recovery Coordinator of the Red Wolf Program, is that correct?

A. That is correct.
Q. When did he leave?
A. I might be mistaken on these dates, but probably 2014, 2015.
Q. And why did he leave?
A. So he was located in Charlotte, I believe -- Charlotte, North Carolina, which is not within the recovery area. We moved that position from Charlotte to Raleigh. And so we made an internal move with the position to Raleigh, and he declined to move. And he resigned.
Q. Why did you decide to move that position from Charlotte to Raleigh?
A. One of the -- the reason for that is the position in Charlotte was not approved by anybody within the Agency, so there was no paperwork. There is no Fish and Wildlife Service office anywhere in there. So we moved the position to the nearest Fish and Wildlife Service office.
That -- that was soon after the changing in management. So that one is here in Raleigh. And we moved the position here and he didn't -- he declined to move and resigned.
Q. Did you make the decision to move the position to Raleigh?

A. Yes.

Q. Was there a Field Coordinator after -- sorry, a Red Wolf Recovery Coordinator subsequent to David Rabon?

A. Yes, we have one right now.

Q. Was there someone immediately after David Rabon?

A. No. We -- at that time, we were going through the budget crisis and continuing resolutions, all that. I believe we had some hiring restrictions, so we didn't have a formal one. We had program staff acting as coordinators.

Q. Who was acting as the coordinator?

A. Most of the time, it was Rebecca or Art. And other times, other staff, but all of the folks within the Red Wolf office.

Q. And how often was that --- I am sorry, let me rephrase. How long did you rely on staff in that acting role?

A. Hard to say, but, you know, a year or more. Pete Benjamin was also one of those that was -- you know, we had now a Senior Fish and Wildlife Service Manager over the Red Wolf, so he was doing a lot of the -- of those roles anyway.

So Pete was officially acting, because he was

the boss now. So he took a lot of those responsibilities. So we never had a -- a gap, in terms of the activities of that coordinator, because we always had staff covering whatever we needed to do.

Q. You mentioned Pete was doing a lot of those roles. What type of -- what of those roles was Pete doing?

A. In general, because I don't have all the details, you know, the coordination with the partners, coordination with the zoos, the Captive Breeding Population folks, and coordination with the State and all of those management relationship building, things like that.

Q. You mentioned there is someone in that position now. Who is in that position now?

A. I -- yes, his name is Joe. We -- we made some changes, so we have the supervisor -- we were able to fill that position last December. Joe -- I keep forgetting his last name, because he is brand new, and I actually haven't lately met the person face-to-face yet. Can you repeat? I got lost in your question.

Q. I said you mentioned that you do have a current Red Wolf Recovery Coordinator, and who is that?

A. Yes. So Joe is the Supervisor. And we added a position as the official coordinator, range-wide. Her

and two other landowners that I don't remember the names, but it was a recommendation from Chris and Art. I met with Kim Wheeler. So I basically did my rounds around meeting with everybody that had something to do with red wolves. I spent that time -- a couple of days -- in the Recovery area.

Q. When you visited Mr. Ferebee's land the other time, who was there?

A. So that time it was Pete, Cindy Dohner. And we had one or two people from the Commission, including Gordon.

Q. And what was the purpose of that meeting?

A. We wanted to see, as a group, you know, the land over there, because we were having so many issues there in terms of the requests and all of that. So we wanted to see it by ourselves, "Okay, what is going on here," and see the resource from the ground.

Q. How much time did you spend on Mr. Ferebee's property at that time?

A. Hard to estimate, but probably two hours, three maximum.

Q. And what did you do while you were there?

A. Just drive around and look at the place and, you know, see the landscape. We went all the way back to the boundary with our refuge, Pocosin Lakes. We talked

about that and some other non-wolf issues like water management and stuff like that.

Q. What did you discuss regarding water management?

A. It -- it is how the -- you know, all of that area is full of canals. And some of them are not being maintained. So when it rains a lot, there is a lot of water overflow and things like that.

Q. What is your understanding of the goal of the Red Wolf Program?

A. What do you mean? In terms of?

Q. What is your understanding of the goal of the Red Wolf Recovery Program?

MR. HESSLER: Objection, vague.

THE WITNESS: You mean in -- do you mean the entire Red Wolf? Well, the main objective is to recover the species. That is the mandate.

BY MS. WEAVER:

Q. Would you say there are other goals?

A. There is a lot of sub-goals, in terms of when you start drilling into the different components of the program. So, you know, they are under a big umbrella, yes.

Q. What are those?

MR. HESSLER: Objection, vague.

Management Plan that was created for the Red Wolf Recovery Program -- I believe it was initially started in 1999?

MR. HESSLER: Objection, vague.

THE WITNESS: Do you have a particular document you are talking about?

BY MS. WEAVER:

Q. I will grab the document in a moment. But in 1999 are you aware that a specific Adaptive Management Plan was ---

A. I remember a technical report that was put together by the wolf people.

Q. Do you know what actions were part of that Adaptive Management Plan?

A. I need to go to the document to remember those.

Q. Are you aware of coyote sterilization that previously occurred in the Red Wolf Recovery Area?

A. I know -- yes, we used that technique in the past, yes.

Q. Can you describe how that technique worked?

A. I am no expert, but sterilizing coyotes so they can hold -- hopefully hold the territory -- not all of them do -- in hopes that we can get a wolf eventually in that territory.

Q. Do you know the time period in which that technique was used?

A. A couple of years, but I cannot pinpoint the period. I wasn't engaged in -- it was in use before I got here, that is for sure.

Q. Do you know if that technique is used any longer in the Red Wolf Recovery Area?

A. I believe -- and I might be mistaken -- that if needed, we will be using it within Alligator River National Wildlife Refuge or Pocosin Lakes. It is still available, but I don't know if we are using it right now with those populations.

Q. Do you know if it is used on private lands in the Red Wolf Recovery Area right now?

A. No. We stopped doing that on private lands.

Q. And who made the decision to stop doing that?

A. It was a, you know, coordinated decision. I believe the actual decision memo was signed by Cindy, but I made the official recommendation.

Q. And when was that done?

A. I -- I don't remember the exact time right now. I will need to go back to the documents and ---

Q. Do you have an idea of the year?

MR. HESSLER: Asked and answered, counsel.

THE WITNESS: No.

BY MS. WEAVER:

Q. Are you familiar with the practice of releasing captive red wolves into the wild population?

A. Yes.

Q. Yes. Can you describe that technique as it was used by the Fish and Wildlife Service in the Red Wolf Recovery Program?

A. The only thing I can say is that we got animals from captivity and released them. How and the details, I am not familiar with that part.

Q. Is that practice still occurring?

MR. HESSLER: Objection, vague.

THE WITNESS: No.

BY MS. WEAVER:

Q. Is the practice of releasing captive red wolves into the wild population in eastern North Carolina continuing to this date?

A. No.

Q. Do you know when that was stopped?

MR. HESSLER: Objection, vague.

THE WITNESS: I will need to go back to the document, but ---

BY MS. WEAVER:

Q. Do you know who made the decision to stop releasing captive wild red wolves into the population?

A. I believe it was -- the actual document was sent by Cindy or signed by her, but it was elective, you know, like, it is typical that we do make these decisions in coordination with everybody.

Q. Would you say that you made this decision, as well?

A. I would be making the official recommendation, yes.

Q. Why did you make the decision to stop coyote sterilization in the Red Wolf Recovery Area?

MR. HESSLER: Objection, mischaracterizes prior testimony.

THE WITNESS: Can you repeat?

BY MS. WEAVER:

Q. Why did you make the decision to stop coyote sterilization in the Red Wolf Recovery Area?

MR. HESSLER: Again, objection. Mischaracterizes prior testimony.

THE WITNESS: As a manager, I -- you know, I oversee the entire program. One of the things that -- that is under my responsibility is compliance with regs and all of that. And one of the observations that was made by the program review we did -- independent evaluation of the program, we had an investigation with -- from the Office of the Inspector General, and we got a

for speculation.

THE WITNESS: It depends on the particular situation.

BY MS. WEAVER:

Q. Do you believe it is Fish and Wildlife Services' duty to address declines in endangered species?

MR. HESSLER: Objection, vague.

THE WITNESS: We have the mission to conserve species and work with others as required by the ESA, to try to do our best to conserve and recover species.

BY MS. WEAVER:

Q. I would like to call your attention to Exhibit 29. Can you read the title on the front page?

A. It says, "Resolution Requesting that the United States Fish and Wildlife Service declare the red wolf (canis rufus) extinct in the wild and terminate the Red Wolf Reintroduction Program in Beaufort, Dare, Hyde, Tyrrell and Washington Counties, North Carolina."

Q. Have you seen this document before?

A. One second.

(Witness peruses document.)

Yes.

Q. When did you first see this document?

A. I don't remember. Let's see what is the date

here.

So the document says in January, 2015. So probably soon after.

Q. And who is the document signed by?

A. Gene ---

MR. HESSLER: Objection, mischaracterizes the exhibit. There are two documents in this exhibit.

BY MS. WEAVER:

Q. Who was the first resolution signed by?

A. I see two signatures here: Gene Cogdell, Chairman, and Gordon Myers, Executive Director.

Q. Do you know who Mr. Cogdell is?

A. It says "Chairman."

Q. Have you met him?

A. I don't recall. Maybe I have shaken hands with him, but I really don't -- haven't interacted with him.

Q. You know who Mr. Myers is, that is correct?

A. Yes.

Q. Yes. And you have worked with him extensively?

A. Yes.

Q. Great. Let me point your attention to the bullets on page 2, and the sentence directly before the bullets. "The North Carolina Wildlife Resources

Commission is making a number of requests to the U.S. Fish and Wildlife Service. Those requests include declaring that the red wolf is extinct in North Carolina, terminating the Red Wolf Reintroduction Program for free ranging red wolves in North Carolina; repealing all Federal rules describing, delineating, designating conditions for red wolf restoration in North Carolina, Designating all wild canids, other than foxes on the Albermarle Peninsula as coyotes or coyote-hybrids; designating that no Federal Trust canids exist on the Albermarle Peninsula; and designating that all wild canids on the Albermarle Peninsula are State Trust resources under the jurisdiction of the North Carolina Wildlife Resources Commission."

Did the U.S. Fish and Wildlife Service respond to the first request in that list, declaring that the red wolf is extinct in the wild?

MR. HESSLER: Objection, vague as to "respond.”

THE WITNESS: Not to my knowledge.

BY MS. WEAVER:

Q. Not to your knowledge? Did you respond to this resolution in any way?

A. No.

Q. No. Did the U.S. Fish and Wildlife Service

respond in any way to the request to terminate the Red Wolf Reintroduction Program?

A. No.

Q. Did you respond to any of the other elements of this?

MR. HESSLER: Objection as to "respond," as being vague.

BY MS. WEAVER:

Q. Did the U.S. Fish and Wildlife Service issue a letter in response to this?

MR. HESSLER: Objection, vague, "this."

BY MS. WEAVER:

Q. Or in response to this resolution?

A. I don't remember if we issued anything directed to this.

Q. If the U.S. Fish and Wildlife Service were to respond to this resolution, who would have made that response?

A. It depends. It could be the Regional Director. In some cases even the Director might be responding to things like this.

Q. Would you be involved in a response to this resolution?

A. I probably would be asked to help draft any response or review documents.

Q. Does the same answer apply to the second resolution?

MR. HESSLER: Objection, vague.

BY MS. WEAVER:

Q. The second resolution in this Exhibit begins on page 3.

A. Let me take a look, here.

Q. If you can read that title as well.

A. Yes. This is a "Resolution requesting that the United States Fish and Wildlife Service remove Red Wolves Released onto private lands in the Red Wolf Recovery Area located in Beaufort, Dare, Hyde, Tyrell and Washington Counties, North Carolina." Now, what was the question?

Q. Did you respond in any way to this resolution?

MR. HESSLER: Objection as to vague, as to "respond."

THE WITNESS: No, not to my knowledge.

BY MS. WEAVER:

Q. Did you ever discuss this resolution with Gordon Myers?

A. No. Not -- nothing in specific in here.

Q. Did you ever discuss these resolutions with Fish and Wildlife Service Staff?

A. Staff, yes. They had brought this to my

BY MS. WEAVER:

Q. Do you remember how you met Mr. Ferebee?

A. The first interaction was through e-mails.

Q. And what were those e-mails about?

A. Red wolf.

Q. Red wolves? Did he contact you or did you contact him?

A. He contacted me.

Q. He contacted you? How did he know to reach out to you?

MR. HESSLER: Objection, calls for speculation.

THE WITNESS: I have no idea.

BY MS. WEAVER:

Q. Were you introduced by anyone via e-mail?

A. Not to my recollection.

Q. And do you recall what that first e-mail was about?

A. I don't know if it is the first e-mail, but the first one that I can remember, he was not happy with the Fish and Wildlife Service about the red wolf and the program and the management of it.

Q. Did he make any requests to you at that time in that e-mail?

A. I don't -- don't remember, because I don't

have the e-mail with me.

Q. Did Mr. Ferebee request of you that the Fish and Wildlife Service remove wolves from his property in North Carolina?

A. He has, but I don't know if it is the e-mail -- the first e-mail that we are talking about here.

Q. Do you have an idea of how many times Mr. Ferebee has contacted you to request the removal of wolves from his property in Eastern North Carolina?

A. I don't have a number, but multiple times.

Q. Has Mr. Ferebee contacted you about take authorizations for his property in North Carolina, allowing him to shoot red wolves?

A. He -- yes, he has requested that.

Q. Do you have an idea of how many times he has requested that?

A. No, but multiple times.

Q. I am presenting you with an e-mail chain that will be marked as Plaintiffs' Exhibit 49.

A. Thank you.

Q. This is Bates number U.S. Fish and Wildlife Service 0018668 through 18670.

(PLAINTIFFS EXHIBIT 49 WAS MARKED FOR IDENTIFICATION.)

This is a 2013 e-mail chain between you and

meeting.

Q. Who did the talking?

A. Mr. Ferebee was, you know, giving the entire history of his relationship with the Fish and Wildlife Service.

Q. Is there a reason you had that meeting at the Wildlife Resources Commission office?

A. It was accessible and free, and it is right there -- easy access to.

Q. Where is Mr. Ferebee located?

A. Well, his farm is within the NEP, but I know that he doesn't live there. But I don't know where he lives.

Q. Have you met with Mr. Ferebee at any other locations, other than the Fish and Wildlife Service office, his farm, the Wildlife Resources Commission office?

A. No, not that I can remember.

Q. You mentioned previously that he had your cell phone number. How did he get your cell phone number?

A. Yes. That was my work phone number -- phone number. And that one is -- you know, especially in this area, we work a lot with phones because you don't have an office. And we might travel. That is usually the most common number to get me.

S I G N A T U R E

I HAVE READ THE FOREGOING PAGES 6 THROUGH 244 WHICH CONTAIN A CORRECT TRANSCRIPT OF THE ANSWERS MADE TO THE QUESTIONS HEREIN RECORDED. MY SIGNATURE IS SUBJECT TO CORRECTIONS ON ATTACHED ERRATA SHEET, IF ANY.

(SIGNATURE OF LEOPOLDO N. MIRANDA)

STATE OF Georgia

COUNTY OF DeKalb

I CERTIFY THAT THE FOLLOWING PERSON PERSONALLY APPEARED BEFORE ME THIS DAY, AND I HAVE PERSONAL KNOWLEDGE OF THE IDENTITY OF THE PRINCIPAL OR HAVE SEEN SATISFACTORY EVIDENCE OF THE PRINCIPAL'S IDENTITY, OR A CREDIBLE WITNESS KNOWN TO ME HAS SWORN TO THE IDENTITY OF THE PRINCIPAL, ACKNOWLEDGING TO ME THAT HE OR SHE VOLUNTARILY SIGNED THE FOREGOING DOCUMENT FOR THE PURPOSE STATED HEREIN AND IN THE CAPACITY INDICATED:

Leopoldo N. Miranda
(NAME OF PRINCIPAL)

June 30, 2017
(DATE)

(SIGNATURE OF NOTARY)

Laura N. Maloof
(NOTARY'S PRINTED NAME)

(OFFICIAL SEAL)

LAURA N MALOOF
NOTARY PUBLIC
MY COMMISSION EXPIRES AUGUST 22, 2020
FULTON COUNTY, GEORGIA

****

I, MICHAEL B. CARTER, NOTARY/REPORTER, DO CERTIFY THAT THE FOREGOING TRANSCRIPT WAS DELIVERED TO THE WITNESS EITHER DIRECTLY OR THROUGH THE WITNESS' ATTORNEY OR THROUGH THE ATTORNEY RETAINING THE WITNESS ON ______________________, AND THAT AS OF THIS DATE, I HAVE NOT RECEIVED THE EXECUTED SIGNATURE PAGE OR ERRATA SHEET.

THEREFORE, MORE THAN 30 DAYS HAVING ELAPSED SINCE THE RECEIPT OF THE TRANSCRIPT BY THE WITNESS, THE SEALED ORIGINAL TRANSCRIPT IS HEREBY FILED WITH THE ORDERING ATTORNEY BY MEANS OF PRIORITY MAIL, IN ACCORDANCE WITH THE NORTH CAROLINA RULES OF CIVIL PROCEDURE.

(DATE)

MICHAEL B. CARTER, NOTARY/REPORTER
NOTARY NUMBER 19960030065
MY COMMISSION EXPIRES FEBRUARY 15, 2021

NAME Leopoldo Narciso Miranda DATE: June 28, 2017 CASE NO.: 2:15-CV-42-BO (E.D.N.C.)

Page #	Line #	Correction:	Reason for Change
6	19	Change "personal" to "personnel"	misspelling
13	13	Change "87" to "88"	Wrong year
13	18	Change "start" to "started"	Grammar
13	20	Change "---" to "I"	Grammar
14	3	Change "Comparative" to "Cooperative"	Misspelling
16	17	Add "we are" between "Service," and "always	Grammar
20	22	Change "embattlements" to "environments"	Misspelling
27	3	Change "was" to "is"	Grammar
28	1	Change "Official" to "U.S. Fish and"	Misspelling
30	18	Change "muscles" to "mussels"	Misspelling
30	22	Change "NIMFs" to "NMFS"	Misspelling
36	25	Change "Caribbeans" to "Caribbean"	Misspelling
59	8	Change "is" to "was"	Grammar
70	20	Change "lately" to "really"	Grammar
72	15	Change "August" to "September"	Wrong month
75	10	Change "—" to "the regional office"	Missing words
77	22	Change "August" to "September"	Wrong month
79	15	Change "August" to "September"	Wrong month
80	4	Change "—" to "remember"	Missing words
88	2	Change "—" to "yours"	Missing word
96	1	Change "It" to "She is the supervisor"	Grammar
100	2	Change "elective" to "collective"	Misspelling
100	24	Delete "with"	Grammar
106	25	Change "16" to "2012"	Wrong year
114	20	Change "—" to "agreement	Missing word
115	9	Change "August" to "September"	Wrong month
124	3	Change "August" to "September"	Wrong month
126	3	Add "they" between "that" and "decided"	Missing word
130	25	Add "know" between "don't" and "what"	Missing word
132	22	Add "know" between "don't" and "the"	Missing word
150	8	Change "Directory" to "Directorate"	Misspelling
162	10	Change "will" to "would"	Grammar
164	5	Add "I received" between "after" and "the"	Grammar
164	5	Delete "had been"	Grammar
182	25	Change "her" to "here"	Misspelling
194	12	Add "time" between "only" and "that"	Missing word
196	12	Change "that" to "they"	Misspelling
198	8	Change to "The first time I heard this was at that visit that I"	Missing words
200	2	Change to "conversation is between staff and	Missing words

		management"	
202	20	Add "team" after "plan"	Missing word
216	8	Change "added" to "additional"	Misspelling
222	22	Change "---" to "take request"	Missing words

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF NORTH CAROLINA
NORTHERN DIVISION

RED WOLF COALITION, DEFENDERS OF WILDLIFE, AND ANIMAL WELFARE INSTITUTE,	)	
PLAINTIFFS,	)	
V.	)	NO. 2:15-CV-42-BO
THE UNITED STATES FISH AND WILDLIFE SERVICE, DAN ASHE, IN HIS OFFICIAL CAPACITY AS THE DIRECTOR OF THE UNITED STATES FISH AND WILDLIFE SERVICE; CYNTHIA K. DOHNER, IN HER OFFICIAL CAPACITY AS REGIONAL DIRECTOR OF THE UNITED STATES FISH AND WILDLIFE SERVICE SOUTHEAST REGION,	)	
DEFENDANTS.	)	

DEPOSITION OF PETER MARTIN BENJAMIN

WEDNESDAY, MAY 31, 2017

GOVERNOR'S BOARD ROOM

RALEIGH MARRIOTT CITY CENTER

500 FAYETTEVILLE STREET

RALEIGH, NORTH CAROLINA

9:00 A.M.

VOLUME 1

PAGES 1 THROUGH 252

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T A B L E O F C O N T E N T S

EXHIBITS (CONT'D)

EXHIBITS (CONT'D)

EXHIBITS (CONT'D)

And we got some new staff there. We just hired the assistant field supervisor who came on in February. So I am talking to him more often than I would other folks.

BY MS. WEAVER:

Q. So you mentioned the Manteo office came under your supervision in 2013. How was it managed before that?

A. That was December 2013. Prior to that, it was organized under Refuges. So they would have reported to the Refuge manager, and then up through the Refugee chain.

Q. And who was the Refuge manager in December 2013?

A. Oh, Mike Bryant.

Q. Mike Bryant?

A. Mike Bryant.

Q. And do you know why that reorganization occurred?

A. I don't exactly, no. I kind of -- I was kind of brought in at the tail-end of that discussion. I will note that it was -- you know, it is uncommon for an Endangered Species Program to be under Refuges. Ecological Services does virtually all endangered species work for Fish and Wildlife Service. Not -- it doesn't do

you came in on the tail-end of the discussions as it was being shifted?

A. Yeah.

Q. Did you -- what were those discussions that you came in on the tail-end of?

A. Where I came in, the -- the only discussion left was whether it was going to be organized under the regional office, like a lot of our recovery programs are, for a -- for a lead, or if it was going to be -- remain under a field office. So the decision was, obviously, to put it under me.

Q. Has that office -- has the work of that office changed since it was shifted?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: It -- I think I mentioned earlier that they -- they are taking on more, broader role in everything the ES office does, so it was set up as fundamentally a -- the -- the red wolf office. But now we are doing stuff with bats, black rails, sea turtles, plovers.

BY MS. WEAVER:

Q. You mentioned Manteo was set up as the red wolf office. Was that when it was under Refuges?

A. Yes.

Q. Yes. Okay. We started talking about

time?

A. That was probably about the same to maybe a bit more.

Q. 2015?

A. Probably more, still.

Q. What about 2014? How much of it was your time then?

A. Probably -- actually, I got to back-track. In 2015, it was actually -- no. I get my dates all confused. 2016 is actually a fairly substantial, probably more than 75 percent. 2015 -- well, half or better. 2014, probably a little more, being brand new to it. Probably spent three quarters of my time or better.

Q. Spending that much of your time on this one field office, what types of work were you doing?

MS. WILLIAMS: Objection. Mischaracterizes prior testimony.

THE WITNESS: Mostly, it was -- it was learning. Right? I -- I -- like I said, not knowing much about red wolves or the program prior to that, you have to get to know your new staff; You have to learn the program. You have to -- you know, of course, the staff are adjusting to just the realignment from Refuges to ES. There is a little bit of difference in culture and practice.

So you know, that is what most of your time spent doing. It is just getting to know the program and its people, and trying to learn as much as I can as fast as I can.

BY MS. WEAVER:

Q. How would you say the culture is different between Refuges and ES?

A. The Refuges is very much a land management sort of agency -- well, division within the agency. So it is not absolute, of course, but ES works much more with other federal agencies. We work much more with the -- with private landowners. We work much more, you know, across the landscape.

And it is hard to describe. I can't really describe it, but it -- it kind of affects the way the two divisions operate. They are just -- they are just different.

Q. Going back to communications, how often did you communicate with private landowners?

A. I talked to private landowners -- me, personally -- probably a few times a month, on average. On -- you know, it could be anything that my office is engaged in.

Q. And you said a few times a month?

A. Uh-huh.

A. Oh, it was on the ground, yeah.

Q. Who were you out with then?

A. Art and Ryan.

Q. Have you been involved with any other adaptive management efforts in the Red Wolf Recovery area ---

MS. WILLIAMS: Objection.

BY MS. WEAVER:

Q. --- on the ground?

A. On the ground?

MS. WILLIAMS: Objection. Vague, "involved."

THE WITNESS: No.

BY MS. WEAVER:

Q. Going back to the Red Wolf Program, has there been a red wolf coordinator throughout the history of the program?

A. I guess I don't know, because my experience is only since late 2013. So throughout the history, I ---

Q. Was there a red wolf coordinator in 2013?

A. Yes.

Q. Who was that?

A. David Rabon.

Q. David Rabon. And what were David's duties?

A. I can only speak from when I started. He supervised the field staff and was -- would have been

responsible for overall recovery coordination. That would mean dealing with the folks in the species survival program.

Q. And how long was David with the service? I am sorry. How long was David in that position of the red wolf coordinator?

A. I don't recall when he started. Four or five years, I would think.

Q. When did he leave the Recovery coordinator position?

A. Yeah. That would have been -- I can't remember a specific date for you. I want to say it was in early 2015.

Q. Early 2015?

A. Sounds right.

Q. Did someone take over that position after David left?

A. No.

Q. No. Who took over those duties after David left?

MS. WILLIAMS: Objection. Asked and answered.

THE WITNESS: Duties -- duties. I -- I became a supervisor of the staff. I guess, what other duties you specifically do you want to know about?

BY MS. WEAVER:

Q. If David was in charge of Red Wolf Recovery, was there someone specifically in charge of Red Wolf Recovery after he left?

A. Not a person, no. His duties were kind of divided amongst us.

Q. How did David's duties compare to Emily's duties now?

A. Emily is not supervisory. She is the Recovery Lead. So that is a difference.

Q. What does "Recovery Lead" mean?

A. Well, I think I mentioned earlier, with most species -- endangered species in Ecological Services, there is somebody assigned as the lead that is responsible for tracking the -- the broader recovery efforts related to that species. So with wolves, it is coordination with the captive program. It is the -- doing things like the species status assessment, leading those types of efforts. With wolves, it is the SSP coordination, those kinds of duties.

Q. How do you work with Emily?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: Well -- yeah. You mean in terms of how do we interact or ---

BY MS. WEAVER:

similar to the exhibit, unless you see something I am missing.

(Witness peruses documents.)

It is not there. Let's go back here.

BY MS. WEAVER:

Q. Mr. Benjamin, in your opinion, what were the greatest threats to Red Wolf Recovery when you took over the program?

A. They -- the -- the primary threat to the red wolf's existence from the time it was listed, as I understand it, is hybridization with the coyotes.

Q. Would you say that controlling hybridization is an important component to red wolf recovery?

A. Yes.

Q. What efforts did you undertake to control hybridization with coyotes?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: Well, I -- I don't do field work, as we have established. So I received the monitoring of the population. I -- we -- we do the trapping. The crew does. We have removed hybrids under my -- since I have been here. And we do continue to monitor the sterile coyotes that we have radio collars on.

BY MS. WEAVER:

Q. Were there hybrids captured in 2016?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: You mean -- I -- I believe so, yes.

BY MS. WEAVER:

Q. Was a decision made at any time during your tenure to no longer capture or sterilize coyotes under the Adaptive Management Plan?

A. Yes.

Q. Who was that decision made by?

A. I don't know specifically, but it was -- it was announced by our regional director.

Q. And who is the regional director?

A. Cindy Dohner.

Q. You did not make that decision; is that correct?

MS. WILLIAMS: Objection. Asked and answered.

THE WITNESS: Right.

BY MS. WEAVER:

Q. Was it someone above you who made that decision?

MS. WILLIAMS: Objection. Asked and answered.

THE WITNESS: In terms of our chain of

command, yeah, that is -- that is correct.

BY MS. WEAVER:

Q. When was that done?

A. That ---

MS. WILLIAMS: Objection. Vague.

THE WITNESS: The decision was made?

BY MS. WEAVER:

Q. The decision was made to no longer use the adaptive measure.

A. I don't know the specific date when that decision was made, but it was announced -- I think we made that announcement in -- man. I don't know the date. That announcement was in relation to -- we did that in 2015, I want to say.

Q. 2015?

A. That doesn't sound right. I guess I don't recall. When was that announcement? I don't recall. There was a press release and everything. I can't remember. I think it was 2015.

Q. Do you know if capture and sterilization efforts ended before that announcement was made?

A. Well, again, that is -- that is a vague question, because that activity is seasonal. So we may have well been done for the season. You know, most of our trapping efforts occur in the cool season, you know

-- October through, maybe, March.

Q. So the decision was announced in 2015?

A. Yeah. And I want to say it was in September of 2015, but I don't know if that is right. If that is the case, then, yes, we would have ceased those activities the prior winter.

Q. Did you provide input into whether or not to continue capture and sterilization of coyotes?

MS. WILLIAMS: Objection. Vague as to providing input.

THE WITNESS: Provide input. Provide input. Yes.

BY MS. WEAVER:

Q. Can you tell me what that input was?

A. Well, I can't recall the specific format or form of it, because we were talking about a lot of things. So could you be more specific, maybe, in terms of ---

Q. Did you ever recommend termination of capture and sterilizing coyotes?

A. No.

Q. Did you ever recommend maintaining the capture and sterilization of coyotes?

A. Yes.

Q. Who did you make that recommendation to?

A. It would have been my boss at the time, Michelle and Leo.

Q. Do you know when that was?

A. You see how good I am with dates. Probably sometime in -- have I got this right? Sometime in 2014 or 2015. Probably 2015, yeah.

Q. Why did you recommend the coyote capture and sterilization be continued?

A. Well, that was the views of the staff who I supervisor. You know, I had been relying that to the regional office.

Q. Which of your staff did you consult with about this?

MS. WILLIAMS: Objection. Mischaracterizes prior testimony and vague.

THE WITNESS: The -- I consider the staff to be a team. So, generally, we talk about things as a team. But I don't know if I could say I talked to a particular member of the staff only about that.

BY MS. WEAVER:

Q. Did you provide other input to Michelle and Leo at this time about the operation of the Red Wolf Recovery Program?

MS. WILLIAMS: Objection. Vague. “Provide input” and "at this time."

MS. WILLIAMS: I am sorry. Can you take a quick five-minute break to talk about that?

MR. HESSLER: We just want to make sure we are not going into any privileged territory, that is all.

MS. WILLIAMS: Just a five-minute break. Thank you.

MS. WILLIAMS: OFF THE RECORD. 11:33 A.M.

(A BRIEF RECESS WAS TAKEN.)

MS. WEAVER: ON THE RECORD. 11:41 A.M.

BY MS. WEAVER:

Q. Was there a decision made to end reintroductions of wolves into Eastern North Carolina?

A. There was -- yes, there was a decision made to suspend that.

Q. Who made that decision?

A. I don't know. It was above my level.

Q. Above your level. When was that decision made?

A. It was that same time as that announcement that we were referring to earlier, which was -- I still think that was in 2015.

Q. When were you made aware of that decision?

A. At a -- at the time of the announcement.

Q. Was there a decision made to end pup fostering?

A. Yes.

Q. Was that made at the same time?

A. Yes, it was in that same time frame. Yeah.

Q. So is it correct that pup fostering, reintroductions, coyote sterilization were all -- there was a decision to end all of those at the same time?

MS. WILLIAMS: Objection. Mischaracterizes prior testimony. Vague.

THE WITNESS: Reintroductions means -- I guess that includes pup fostering. That would have been made all around the same time.

BY MS. WEAVER:

Q. Was your input solicited for those decisions?

MS. WILLIAMS: Objection. Vague as to "input" and "solicited."

THE WITNESS: You mean by my boss?

BY MS. WEAVER:

Q. By your superiors?

A. Yes. Yes.

Q. What type of input did you provide?

A. We provided -- "we" meaning me and the team -- my staff would have provided, you know, factual background, reports from the field, documentation of what we had done during that time. I recall -- I recall reviewing the -- a report by the Wildlife Management

decline in the red wolf population?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: That is a vague question, because it depends on what you mean by "respond."

BY MS. WEAVER:

Q. What is the goal of the Red Wolf Recovery Program?

A. There you go. It is, as with all endangered species, to get the animal to a point where it no longer needs the protection of the Act and can be de-listed,

Q. Does that include increasing numbers on the landscape?

MS. WILLIAMS: Objection. Calls for speculation.

THE WITNESS: Generally, yes. A recovery means the animal is restored to the wild.

BY MS. WEAVER:

Q. Do these numbers appear to be approaching or moving toward recovery or moving away from recovery?

MS. WILLIAMS: Objection. Vague, as to "these numbers."

BY MS. WEAVER:

Q. The numbers on Exhibit 4?

MS. WILLIAMS: There are several numbers on Exhibit 4. What exactly are you referring to?

Emily. That would be six.

Q. And how many of those six individuals working on red wolves when you started -- how much time did they actually spend?

MS. WILLIAMS: Objection. Vague, "spend."

THE WITNESS: Yeah.

BY MS. WEAVER:

Q. Let's go through the employees one by one.

A. Good.

Q. So how much time did David Rabon spend on red wolves in 2013, when you started?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: Are we talking about his -- like, a percentage of his duties ---

BY MS. WEAVER:

Q. (Interposing) Yes.

A. --- that were red wolf versus other things? When -- when I started -- yeah, his -- I believe all of his job duties were red wolf related.

Q. Okay. And what about Becky Bartel?

A. The same.

Q. Okay. What about Art Beyer?

A. 2013 -- it was the same.

Q. What about Ford Mauney?

A. Yeah, that would have been all red wolf.

Q. Ryan Nordsven?

A. All red wolf, but I believe he also has some collateral firefighting duty.

Q. What about Mike Morris?

A. He would have been all red wolf.

Q. And current staff ---

A. Uh-huh.

Q. --- how much red wolf work is Joe Madison doing? What percentage of his time is dedicated to Red Wolf Recovery?

A. Hard to say, day in and day out, but to characterize it, it is probably three-quarters.

Q. What about George Colby?

A. That is -- it is probably most of his time, is red wolves or red wolf support.

Q. Okay. What about Mike Morse?

A. Mike now divides his time between wolves and bats, mostly. The mix is going to be variable, depending on the season, mostly.

Q. What would his overall annual time look like?

A. He is probably -- I guess, he is probably three-quarters.

Q. What about Ryan Nordsven?

A. Probably similar to Michael.

Q. Shaun Olson?

A. And probably also similar to the other fellows.

Q. And how much of time for Amy Weller (phonetic)?

A. I don't know, exactly. I think she is all red wolves.

Q. Has the mixture of work that Ryan Nordsven has been doing changed from 2013 to 2017?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: Yeah, can you be more specific about mixture?

BY MS. WEAVER:

Q. How much work is Ryan doing capturing red wolves now versus in 2013?

A. Well, right now, he is not doing any, because it is hot.

Q. How about January 2017?

A. At that time, he was spending a good portion of his time doing red wolf work. Probably would have been about in line with what I said, half to three quarters.

Q. Okay. What work is he specifically doing in the field in January?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: Ryan?

recall. We would have to talk about a specific.

Q. Okay. You comment in this e-mail about receiving a large number of such requests?

A. Right.

Q. And you say, "I will cc you on all such responses"?

A. Uh-huh. Right.

Q. Do you have an idea of how many removal requests you received?

A. This was ---

MS. WILLIAMS: (Interposing) Objection. Vague.

THE WITNESS: Can you be specific about a time frame?

BY MS. WEAVER:

Q. Over the time frame referred to in this e-mail?

A. Okay. This time frame we have been talking about, it says it is August 2014 -- we would have been talking about that episode in mostly July of 2014 where we did get a large number of requests. And by large number, I think our final count was around 400.

Q. And In this e-mail, you say, "I will cc you on all such response"?

A. Correct.

Q. And it requests a number of things. Can you read out those things that it requests?

A. Yeah, sure. "Declare the federal -- declare in federal rules that the red wolf is extinct in the wild in North Carolina. Terminate the red wolf Reintroduction Program for free-ranging red wolves in North Carolina. Repeal all federal rules describing, delineating, and designating conditions for red wolf restoration in North Carolina. Designate all wild canids other than foxes on the Albemarle Peninsula as coyotes or coyote-hybrids. Designate that no federal-trust canids exist on the Albemarle Peninsula, and designate that all wild canids on the Albemarle Peninsula are state-trust resources under the jurisdiction of North Carolina Wildlife Resources Commission."

Q. Did the U.S. Fish and Wildlife Service respond to these requests from the North Carolina Wildlife Resources Commission?

MS. WILLIAMS: Objection. Vague as to "requests."

THE WITNESS: I don't recall a written response.

BY MS. WEAVER:

Q. Do you know if Cindy Dohner responded to these requests?

MS. WILLIAMS: Objection. Calls for speculation.

THE WITNESS: Yeah, I don't know what kind of communications may have been between her and the Commission.

BY MS. WEAVER:

Q. Did you respond to these requests?

A. No, not directly.

Q. Did you speak with your supervisors about these request?

A. We did speak about them.

Q. Did you express concern about these requests?

MS. WILLIAMS: Objection. Vague as to "concern."

THE WITNESS: I recall having concerns about these requests.

BY MS. WEAVER:

Q. What were the nature of your concerns?

A. Well, I have difficulty remembering completely. But as I recall -- let me read this for a minute.

(Witness peruses document.)

I recall having some concerns about some of the specific language in these resolutions -- some of the "whereas" clauses.

that correct?

A. Well, yeah. Like I said, my guys will sometimes trap outside the normal trapping season, as long as the weather cooperates.

Q. So this is an authorization to a private trapper? Would you consider him one of your guys?

A. The ---

MS. WILLIAMS: Objection. Vague.

THE WITNESS: He doesn't work for me, obviously. But we have in the past used private trappers to, you know, essentially, supplement our field capabilities.

BY MS. WEAVER:

Q. Were those private trappers considered agents of the Fish and Wildlife Service?

A. That is how they are ---

MS. WILLIAMS: (Interposing) Objection.

THE WITNESS: Okay.

MS. WILLIAMS: Yes. Objection. Calls for a legal conclusion.

THE WITNESS: I believe this calls them -- what do we call them? Sub-permittees? I forget the exact language we used. It is probably in here somewhere. Sub-permittee, right.

BY MS. WEAVER:

Q. Did these sub-permittees receive any special training with regard to red wolves?

A. Not by us. The -- the letter here lays out a number of conditions they have to operate under.

Q. Is there any way they are going to get special training in a species that it wants -- that the Wildlife Resources Commission wants to go extent?

MS. WILLIAMS: Objection. Constitutes testimony by Counsel. And it is argumentative and vague.

BY MS. WEAVER:

Q. Going back to responding to Landowner requests to remove wolves, you mentioned over 400 requests. How did you handle the work load when that was occurring, with your staff?

MS. WILLIAMS: Objection. Vague, "handle work load."

THE WITNESS: Right. How did we handle it? If I recall, we had the work divided up amongst the field biologists, in terms of who was going to contact whom. I think Art or Becky, or potentially Matt Butts at the time, would have been the -- an intern or keeping track of -- of the individual requests, as you were -- you know, which ones were closed out, which ones were still active, or that -- it was kind of just divided amongst staff.

A. No.

(PLAINTIFFS EXHIBIT 34 WAS MARKED FOR IDENTIFICATION.)

Q. Thinking more about the removal question, I would like to introduce document 34, an e-mail from you to Leo Miranda asking for input on some issues raised by your staff. And this is Bates number 0011725 and 726.

(Witness peruses document.)

Have you had a chance to look over the e-mail?

A. Yes.

Q. So this e-mail is about how long to hold and whether to release captured animals, correct?

A. Yes, generally.

Q. Can you describe what issues you are concerned with here?

A. Well, I don't know, really -- the first line references issues Art raises. But I don't have their -- there must have been something prior that I don't have in front of me. But in the e-mail, we talk about -- I am talking about -- I guess there is a few things here. How long might we hold an animal, how many times are we going to try to remove the same animal from a particular property.

You know, it relates to how we are using our staff resources relative to other work we may need to get

done, those types of issues.

Q. What is your suggestion about how to use your staff resources on this issue, as relayed in this e-mail?

A. Yeah. We are talking about one thing in here, which is, you know -- and I say right at the beginning, I -- I don't have any direct experience. I am still, in October 2014 -- still learning about wolves, so relying on Art, largely.

But he and the crew had told me that in their experience, there is some benefit to holding an animal for awhile if you don't necessarily want it to go back where it came from. And this is more -- as Art and the fellows have told me, it is not an exact science. It is their experience that you can kind of diminish the homing instinct, if you will, kind of interrupt the animal's bond with its territory. And it may be less likely to return.

So -- but then, if you hold an animal too long, it becomes too habituated to the caretakers. That is an animal that may become too tolerant, too comfortable around people. And you don't want that, either. So you are kind of looking for a balance there.

And it is really a judgment by the biologist of what is appropriate. They have a much better sense for the individual behavior of these animals, certainly,

than I do, or anybody else.

And then there is the issue of, you know, if the animal does return, then what are we going to do? Because our rule talks about behavioral problems. And you -- you could consider that either an animal that is too tolerant of people or it has really honed in and habituated to a particular place where we know it is not welcome.

Then repeated efforts to remove that animal kind of become fruitless, because the animal is going to be -- it is going to become trap shy and impossible to catch, or you are just devoting too much staff time to one animal, where we have got a whole program to run. So we are trying to find, in this e-mail, some way to balance those kind of competing needs.

Q. At this time, were you concerned about the work load burden of landowner removals on your staff?

A. Well, you know, always I am having to balance, you know, the -- how we are using our resources, financial or staff, relative to all the things that are going on. So it is -- I would say that is an ordinary part of supervision.

Q. In this e-mail, you say to Leo, "We need your input on these issues"?

A. Uh-huh.

over a hundred animals in the wild, despite those community concerns?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: We had a population of over a hundred animals, you know.

BY MS. WEAVER:

Q. Is there a benefit to maintaining a wild population of red wolves?

MS. WILLIAMS: Objection. Vague. Lacks geographical limitation and other things.

THE WITNESS: Benefit to maintaining a wild population?

BY MS. WEAVER:

Q. Is there a benefit, in terms of red wolf recovery to maintaining a wild population?

MS. WILLIAMS: Objection. Vague.

THE WITNESS: Recovery is the objective. And that means somewhere, at some time, we will have a -- one or more wild populations.

BY MS. WEAVER:

Q. Is the population of red wolves in the wild in Eastern North Carolina the only population of wild red wolves?

A. Yes.

Q. Has other reintroduction sites been tried but

S I G N A T U R E

I HAVE READ THE FOREGOING PAGES 7 THROUGH 250 WHICH CONTAIN A CORRECT TRANSCRIPT OF THE ANSWERS MADE TO THE QUESTIONS HEREIN RECORDED. MY SIGNATURE IS SUBJECT TO CORRECTIONS ON ATTACHED ERRATA SHEET, IF ANY.

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STATE OF North Carolina

COUNTY OF Wake

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Peter M. Benjamin

(NAME OF PRINCIPAL)

7-10-2017

(DATE)

Kathy A. Vest.

(SIGNATURE OF NOTARY)

Kathy A. Vest.

(NOTARY'S PRINTED NAME)

KATHY A. VEST NOTARY PUBLIC WAKE COUNTY, NC

(OFFICIAL SEAL)

MY COMMISSION EXPIRES 5/6/2018

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I, MICHAEL B. CARTER, NOTARY/REPORTER, DO CERTIFY THAT THE FOREGOING TRANSCRIPT WAS DELIVERED TO THE WITNESS EITHER DIRECTLY OR THROUGH THE WITNESS' ATTORNEY OR THROUGH THE ATTORNEY RETAINING THE WITNESS ON ____________________, AND THAT AS OF THIS DATE, I HAVE NOT RECEIVED THE EXECUTED SIGNATURE PAGE OR ERRATA SHEET.

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NOTARY NUMBER 19960030065
MY COMMISSION EXPIRES FEBRUARY 15, 2021

NAME: PETER MARTIN BENJAMIN   DATE: MAY 31, 2017   CASE NO.: 2:15-CV-42-BO

Page #	Line #	How You Wish The Line or Phrase to Read	Reason for Change
24	21	Change “going on” to “going in”	Incorrect term
25	22	Change “there is” to “there are”	Grammar
33	11	Change “Brian” to “Ryan”	Incorrect name
36	18	Change “But it” to “But it is”	Incorrect term
46	13	Change “Brian” to “Ryan”	Incorrect name
50	10	Change “is” to “are”	Grammar
59	25	Delete “you” between “duties” and “specifically”	Incorrect term
66	16	Change “of a grievance” with “agreements”	Incorrect term
75	5	Change “temporary” to “temporal”; Delete “yes”	Incorrect term
80	12	Delete “so—yes”	Clarifying response
82	11	Change “geographical” to “geographic”	Incorrect term
100	14	Insert “not” between “would” and “have”	Clarifying response
100	15	Changed “not approved” to “approved”	Clarifying response
107	20	Change “Mr. Hess” to “Mr. Hessler”	Incorrect name
113	10	Change “orientation” to “limitation”	Incorrect term
119	8	Insert “to” between “as” and “the”	Clarifying response
134	20	Delete “come to”	Incorrect term/clarifying response
135	24	Insert “?” after “extinction”	Clarifying response
148	25	Insert “no” between “and” and “temporal”	Clarifying response
149	1	Change “limitations” to “limitation”	Clarifying response
150	11	Change “services” to “the Service”	Incorrect term
150	23	Delete “are you—yes.”	Clarifying response
153	7	Change “Commissions’” to “Commission’s”	Incorrect term
153	8	Delete “that”	Incorrect term
157	16	Change “there is” to “there are”	Grammar
209	6	Change “memorandums” to “memoranda”	Incorrect term
222	20	Change “Mr. Hess” to “Mr. Hessler”	Incorrect name
222	25	Change “Mr. Hess” to “Mr. Hessler”	Incorrect name
223	2	Change “Mr. Hess” to “Mr. Hessler”	Incorrect name
231	12	Change “50 CFR § 17.84 C1” to “50 C.F.R. § 17.84(c)(10)”	Incorrect citation to regulations
232	1	Change “Counselor” to “Counsel”	Incorrect term
232	9	Change “answer” to “question”	Incorrect term

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF NORTH CAROLINA
NORTHERN DIVISION

RED WOLF COALITION, DEFENDERS OF WILDLIFE, AND ANIMAL WELFARE INSTITUTE,	
PLAINTIFFS,	
V.	NO. 2:15-CV-42-BO
THE UNITED STATES FISH AND WILDLIFE SERVICE, JIM KURTH, IN HIS OFFICIAL CAPACITY AS ACTING DIRECTOR OF THE UNITED STATES FISH AND WILDLIFE SERVICE; MIKE OETKER, IN HIS OFFICIAL CAPACITY AS ACTING REGIONAL DIRECTOR OF THE UNITED STATES FISH AND WILDLIFE SERVICE SOUTHEAST REGION,	
DEFENDANTS.	

DEPOSITION OF PETER MARTIN BENJAMIN

THURSDAY, NOVEMBER 2, 2017

3rd FLOOR CONFERENCE ROOM

U.S. ATTORNEYS OFFICE

310 NEW BERN AVENUE

RALEIGH, NORTH CAROLINA

8:54 A.M.

VOLUME 1

PAGES 1 THROUGH 265

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T A B L E   O F   C O N T E N T S

EXHIBITS (cont'd)

Q. We can do that.

(PLAINTIFFS EXHIBIT 122 WAS MARKED FOR IDENTIFICATION.)

So this will be Exhibit 122. It is the Rebuttal Expert Report of Pete Benjamin.

(Witness peruses document.)

Do you recognize this document?

A. Yes. Yes.

Q. What is this document?

A. This is my Rebuttal Expert Report of Pete Benjamin. And, yes, the second question you asked was what was the, you know, broad theme of it. So I guess I could summarize briefly by saying that the Red Wolf Recovery Program is at a point where it -- where fundamental change is needed in the way we implement the Recovery Program and the rules that operate the program , because they have not worked to date in terms of producing a viable population of Red Wolves in Eastern North Carolina. And in my opinion, they cannot work.

Q. Thank you for that summary. How long have you worked with the Red Wolf Recovery Program?

A. Since -- as the -- in an official capacity, since December 2013. As I mentioned earlier -- so the Red Wolf Recovery Program was placed under the Raleigh Field Office, which I supervise, at that time. Prior to

that, it was supervised and managed through the Refuge Program.

So formally -- officially, December 2013. But as I mentioned earlier, we had had interactions and had to do things like consultations on Red Wolves since I have been with the Raleigh Field Office.

Q. Like the OLF Case?

A. Yes.

Q. All right.

A. And we did other things for them, even at that time. So when the Red Wolf Program, for whatever reason, needed to do a Section 7 consultation or a NEPA document, the Field Office wrote those, and I would have reviewed and signed them. For example, we built, in 2008 or so, a new Healthcare and Education Facility just south of Columbia. That required a NEPA Environmental Assessment. And we wrote that, did stuff like that.

Q. And you currently supervise the Red Wolf Recovery Program, is that right?

A. The folks that work in and manage the -- the NEP. So I don't, for example, supervise Emily, who we just talked about.

Q. Right.

A. Yes.

Q. Does Emily work with your folks who supervise

sure I am remembering correctly.

BY MS. McGEE:

Q. And I might direct you to Roman numeral 2 of Dr. Vucetich's report, which has a Table of Contents for all of his opinions.

A. Very helpful, yes.

(Witness peruses document.)

So specifically on page 12, the second paragraph of my report, I reference Section 4.2, expert opinion 2 of Dr. Vucetich's report.

Q. And what is that section of Dr. Vucetich's -- Dr. Vucetich's report?

A. His section is entitled "Cessation of Adaptive Management Works Against Red Wolf Recovery."

Q. Do you disagree with that?

A. I say in my report that I -- a little bit. If he is saying in here -- which I think is what the gist is -- is that the red wolf is a conservation reliant species. We reference that in, I think, both of our reports. So it needs active continual management for us to sustain the wild population. And if you stop doing those things for whatever reason, then the population is likely to decline.

That is a little different from saying it works against recovery of the species, because recovery

conservation reliant. And that is a fairly small handful of species, I think, that are maybe never really going to get to the point where it is not at risk of becoming endangered in the foreseeable future, by definition of "threatened." You might get it out of the endangered category, but because the threats are there, we can't mitigate them, there is nothing you can do about it, it will always be at least threatened.

Q. Does the Endangered Species Act or any of its implementing regulations use the term "conservation reliant"?

A. No. Like I said, it is a fairly recent term. It started showing up in the conservation biology literature maybe a decade or so ago. Some of the papers, you know, that were written really start to articulate the concept -- that were written in the 2008 to 2012 kind of time line. So way after the last set of amendments to the Endangered Species Act.

Q. So returning back to your expert report, if you could turn to page 12 ---

A. Uh-huh.

Q. --- toward the bottom of the first full paragraph on page 12 you note that "The red wolf requires management activities identified in the Red Wolf Adaptive Management Plan, and discontinuing those practices leads

to a decline in the population"?

A. Right.

Q. Why have those practices been discontinued?

A. Some of that we touched on it, I think, before lunch. The -- some of the things we have determined are definitely -- we are implementing outside of the confines of the regulations we have promulgated.

Q. And which activities are those?

A. They are releasing -- releasing wolves from captivity into the wild. That is a specific one. Others were -- so we know -- we know we had to stop that until we could get it squared with our regulations. Others, like removal of hybrids from the landscape, we are wrestling a little bit with at what point -- we have had a working definition of what we call hybrid. That is an animal that has less than 77.5 percent red wolf ancestry.

But like I said previously, there is -- there is considerable ambiguity in the act and its implementing regulations on exactly how hybrids are treated. And it is not a clear definition of what a hybrid is. So, you know, we want to make sure we are capturing in our regulations appropriately what actions are -- you know, we are taking with Red Wolves in the NEP area versus what actions we may be implementing with respect to coyotes or non-protected canids. We need to get that square.

And that goes somewhat also to the deployment of placeholders. Because we use coyotes, we also use hybrids as placeholders. So until we can get it to where we are confident in what needs to be covered by regulation and we have those regulations in place, the decision was to basically only do those actions that are explicitly authorized in our current regulation.

Q. Who made that decision?

A. It was above me. It was -- it was announced by the Regional Director last -- that was in 2015. No doubt, she would have done that in consultation with the Director, but I don't know whose actual decision it was.

Q. Is there any document memorializing that decision?

A. We -- yes. There may -- and I don't remember what it is, because we put out a -- we did an announcement. We had a press conference in 2015 that articulated that.

Q. Any other documents?

MR. HESSLER: Objection, to the extent it calls for privileged information ---

THE WITNESS: (Interposing) Yeah.

MR. HESSLER: --- that is covered under the deliberative process privilege.

THE WITNESS: And all I recall are the

Plan. And then we have this (indicating) document, which is an Adaptive Management Plan. And so it is a little different than most other -- it is more detailed than the kind of plans we develop for most endangered species, in my experience, because of the -- you know, the degree to which this is a conservation reliant species. Right? We need to -- most species we deal with, we do not deal with, you know, animal-by-animal.

Q. So with other species, you might refer to the Recovery Plan in the same way that you referred to the Red Wolf Adaptive Management Plan for guidance?

MR. HESSLER: Objection. Calls for a legal conclusion and vague.

THE WITNESS: I think, broadly speaking, that is correct. But the guiding document for most species is usually the Recovery Plan.

BY MS. McGEE:

Q. Okay. In order for the Service to resume Adaptive Management activities, does the Red Wolf Rule need to explicitly authorize adaptive management or simply not prohibit it?

MR. HESSLER: Objection, calls for a legal conclusion.

THE WITNESS: There are -- under 10(j) of the Endangered Species Act, there is just a handful of

things we have to do. We have to coordinate with the States. We have to define the area of the experimental population. We have to make a determination of whether or not that population is essential or non-essential.

We have to describe the number of animals we are going to release. And then we have to determine that establishing this population is in the -- you know, furthers the conservation of the species, and then, by Rule, prescribe whatever kind of special restrictions or measures may be needed to manage that population.

So there is -- I gave all of that as background to say there are going to be some things -- to run a red wolf reintroduction successfully, there are things that are going to have to be explicitly spelled out in the Rule. But I think there is probably going to have to be things that are necessary to make the program successful that maybe are not explicitly referenced in the Rule. But they should be mentioned somewhere: in a Recovery Plan or -- that would be the best place for it.

BY MS. McGEE:

Q. So which camp does Adaptive Management fall in? Does it ---

A. (Interposing) I would say they would probably fall in both.

our collared wolves are definitely on or near the property. That is what they mean by "working."

Q. So looking at this, only nine out of 405 requests were active possible cases where a red wolf was on the private landowner's property?

A. Yeah. And then there is this one down under "closed cases," where there is four that were combined with "working requests." That, if I remember correctly, would have been, like, neighbors, that kind of thing. So we are working it as one thing, but it may have involved a couple of properties.

Q. So you might have had as many of 13 out of 405 requests that actually had Red Wolves on the property?

A. That is right.

Q. Okay. Do you know why the number of removal requests spiked in 2014?

A. Yeah. There was a -- there was an active campaign I would call it, I guess, to stimulate landowners to file requests of this nature -- not carried out by the Fish and Wildlife Service, I would like to note.

Q. Do you know why this campaign was coordinated?

A. No, not specifically. But by this time it was known by some members of the community that there was a difference between what our Regulation said and what we

were doing with respect to removals.

Q. You said members of your community?

A. The community, meaning folks in the five county area.

Q. Do you know who those individuals were?

A. Not all of them. But I can take a good guess at one or two.

Q. Who were they?

A. Oh, I would suspect Jett Ferebee had something to do with a good bit of it.

Q. Anyone else?

A. Beyond that would be kind of just guessing.

Q. And after this spike in removal requests in 2014, what happened to the number of removal requests? Did it go up, did it go down?

A. It tailed off off of this volume, which came in mostly between, if I am remember right, June, July, August of that year -- 2014, but stayed at a level of -- you know, a consistent trickle of one to several a month, probably.

Q. One to several a month?

A. Yeah, that is probably accurate. We probably had some months where nothing happened.

Q. How many of those were from repeat by landowners?

So I just didn't -- this was something I had from -- I forget what else I was doing. So I was able to quickly grab it and pop it in there.

Q. Recycling? Yes. Do you know how many breeding pairs there are on the landscape right now in the wild population?

A. Not exactly.

Q. Approximately?

A. There are at least three, perhaps more. But our ability to know with specificity is -- it has become more limited due to the problems we have talked about already with -- in terms of access to private lands.

Q. And when you say "at least three," how do you know about those three?

A. Those, we saw puppies.

Q. Great.

A. So we weren't able to get our hands on all of those puppies, but -- because one -- because one litter in particular occurred on private lands, we -- staff located the den, couldn't get to it that day, and by the time they came back the next day, the -- they had moved, which is common -- to another location on land we don't have access to. So there -- there may have been more out there, but without the access, it is impossible to verify.

Q. And then the other two breeding pairs, were they on private lands or public lands?

A. One is on public land -- the refuge. The other one -- you know, actually, I have got to correct that, because I think that other one is also only suspected -- no, I think the guys told me it was on private lands. Also, that they were pretty sure that there was a litter, but didn't confirm it, didn't ever lay hands on the puppies.

Q. And ---

A. So that means there is really -- I know for certain, as of Spring, there were two breeding pairs, and possibly a few others.

Q. And when you say "the guys," who do you mean?

A. Yeah. The Field Biologists in the Red Wolf Program.

Q. And who are they?

A. Currently we have Michael Morse, Ryan Nordsven and Shaun Olson.

Q. How many wolves have been killed pursuant to Lethal Take Permits?

A. One.

Q. When did that occur?

A. That was -- what year was that?

Q. Does June 2015 ring a bell?

employee of the Fish and Wildlife Service is required to execute their duties in compliance with applicable law and regulation. That is at least a matter of policy. It is stated somewhere in our policy, but it is probably also just a -- a legal mandate. I don't know where to cite it, but it has got to exist, right? You can't -- you honestly can't, as a federal employee, do things that are contrary to regulations.

Q. So how is an interpretation of a regulation a violation of the regulation?

A. When it exceeds your delegation of authority.

Q. Okay. When did the Red Wolf Recovery Program come under the purview of Ecological Services?

A. It came under my purview, specifically, in December 2013. So, your question is a little -- it has been managed under Refuges. It has -- it has always been an Endangered Species Recovery Program.

Q. Okay. But in the Endangered Species Recovery Program that was previously under Refuges, not under Ecological Services?

A. Right, exactly.

Q. Right. Okay. Was it under the Refuge Program from its inception until 2013?

A. Not exactly. It started at Alligator River National Wildlife Refuge. The lead for it at the time it

was started, Refuge Manager John Taylor. But then we started a reintroduction effort in the Smokeys. Right?

Q. Right.

A. So at that -- for a period, I believe the line of supervision ran through Brian Cole, who was the Field Supervisor in our Asheville Field Office. I believe that when that reintroduction effort was terminated or discontinued, that management devolved back to the Refuge, because the only remaining population was the one in Eastern North Carolina.

Q. And when did that happen?

A. '91?

Q. '91. So before the '95 Rule change?

A. Yeah. Although the '95 Rules, for reasons that aren't clear to me, still speak of the -- no, no, that is not right. Because we didn't officially terminate the -- or discontinue the Smokey Mountain Reintroduction until '98.

Q. Got it.

A. Yeah. So the '95 Rule does still speak to those two populations.

Q. So, then, from '98 until about 2013 ---

A. Yeah.

Q. --- the Red Wolf Recovery Program was under the Refuges, rather than under Ecological Services?

Q. And that is referenced in your report?

A. Yes. And I list that. And I think in my report I am talking about that specific line on 11559, and the other stuff -- the other document that is attached to it that says -- it is just headed "Red Wolf Regulations."

Q. So looking at this guidelines document, where does it state that these guidelines are proposed?

A. It really doesn't, right? It says -- the way I take it is this is a statement of what we intended to do from that point forward.

(Witness peruses document.)

Yeah. It has an effective date on it and everything.

Q. And now I will hand you what will be marked as Exhibit 131. And it is Bates stamped USFWS-0011553.

(PLAINTIFFS EXHIBIT 131 WAS MARKED FOR IDENTIFICATION.)

Do you recognize this document?

A. Well, not -- it -- it doesn't ring a bell immediately. Let me look at it for a minute.

Q. Yes, take your time.

(Witness peruses document.)

A. Uh-huh. Yeah, I have seen this.

Q. Ringing some bells?

together. And until that time, we have to operate under the rules as they are written, as modified by the injunction. And given that set of circumstances, it is my opinion that the population will probably continue to decline until we can get the science and the policy and the regulations on solid footing and all in sync. And then we can move forward.

Q. Would resuming the active management that you have discussed previously help avoid that decline?

A. Let me think about that, because there are a bunch of parts to it.

(Pause.)

If we could release a bunch of animals from the captive population into the wild, that would help offset losses. Maybe -- I don't know if you could do it enough to -- theoretically, you could do it enough to stabilize the population.

Q. How about resuming sterilization of coyotes and the utilization of the placeholder theory?

A. Possibly, if we could do it over -- in key parts of the area. Just sterilizing coyotes willy-nilly doesn't help. And that is not what we have ever done. We have done it in specific locations for specific purposes.

If we could do it in those specific locations

for those specific purposes -- meaning we have access to all of those places -- it might help. In my opinion, though, with the access situation the way it is, our ability to do that in places we need it is at least somewhat limited. It may be limited enough to make it ineffective. I don't know.

Q. In both opinions 3 and 4 you discuss needed changes to the Red Wolf Recovery Program and the Red Wolf Rule?

A. Right.

Q. What specifically would you do to revise the Red Wolf Rule?

A. Oh, man. I touched on it in, I guess, opinion 4. Where did I say it ---

(Witness peruses document.)

I had some broad types of things. The bottom of page 18, the very last line, "In my opinion, what is needed is a Program and accompanying rules that actively engages landowners in red wolf conservation and management, fosters coexistence, engages North Carolina Wildlife Resources Commission and interested non-governmental organizations."

So what I mean by that is you need -- our rules need to -- I think we need to come up with something different to foster tolerance and coexistence.

NAME Pete Benjamin DATE: December 7, 2017 CASE NO.: 2:15-CV-42-BO (E.D.N.C.)

Page #	Line #	Correction:	Reason for Change
20	12	Change “Molly Batey” to “Mollie Beattie”	Misspelling
41	13	Change “Hanko” to “Hankla”	Misspelling
41	22	Change “Hanko” to “Hankla”	Misspelling
59	22	Change “propagated” to “promulgated”	Misspelling
64	5	Change “specie’s” to “species’”	Misspelling
69	14	Change “©” to “(c)”	Misspelling
69	18	Change “©” to “(c)”	Misspelling
69	23	Change “©” to “(c)”	Misspelling
69	24	Change “©” to “(c)”	Misspelling
90	14	Insert “I” to read “also I would have informed”	Grammar
112	16	Change “77.5” to “87.5” percent	Correction
222	8	Change “tow work” to “telework”	Misspelling
233	23	Change “Jane” to “Jamie”	Misspelling
237	9	Change “spit” to “split”	Misspelling
249	8	Change “younger” to “young”	Misspelling
254	11	Change “anything” to “everything”	Correction
254	21	Change “Fuller” to “Ford”	Misspelling
263	1	Change “white nosed” to “writing those”	Misspellings

S I G N A T U R E

I HAVE READ THE FOREGOING PAGES 5 THROUGH 263 WHICH CONTAIN A CORRECT TRANSCRIPT OF THE ANSWERS MADE TO THE QUESTIONS HEREIN RECORDED. MY SIGNATURE IS SUBJECT TO CORRECTIONS ON ATTACHED ERRATA SHEET, IF ANY.

(SIGNATURE OF PETER MARTIN BENJAMIN)

STATE OF North Carolina

COUNTY OF Wake

I CERTIFY THAT THE FOLLOWING PERSON PERSONALLY APPEARED BEFORE ME THIS DAY, AND I HAVE PERSONAL KNOWLEDGE OF THE IDENTITY OF THE PRINCIPAL OR HAVE SEEN SATISFACTORY EVIDENCE OF THE PRINCIPAL'S IDENTITY, OR A CREDIBLE WITNESS KNOWN TO ME HAS SWORN TO THE IDENTITY OF THE PRINCIPAL, ACKNOWLEDGING TO ME THAT HE OR SHE VOLUNTARILY SIGNED THE FOREGOING DOCUMENT FOR THE PURPOSE STATED HEREIN AND IN THE CAPACITY INDICATED:

Peter Benjamin

(NAME OF PRINCIPAL)

12-8-17

(DATE)

Kathy A Vest.

(SIGNATURE OF NOTARY)

Kathy A. Vest.

(NOTARY'S PRINTED NAME)

KATHY A. VEST NOTARY PUBLIC WAKE COUNTY, NC

(OFFICIAL SEAL)

MY COMMISSION EXPIRES 5/6/2018

****

I, MICHAEL B. CARTER, NOTARY/REPORTER, DO CERTIFY THAT THE FOREGOING TRANSCRIPT WAS DELIVERED TO THE WITNESS EITHER DIRECTLY OR THROUGH THE WITNESS' ATTORNEY OR THROUGH THE ATTORNEY RETAINING THE WITNESS ON ______________________, AND THAT AS OF THIS DATE, I HAVE NOT RECEIVED THE EXECUTED SIGNATURE PAGE OR ERRATA SHEET.

THEREFORE, MORE THAN 30 DAYS HAVING ELAPSED SINCE THE RECEIPT OF THE TRANSCRIPT BY THE WITNESS, THE SEALED ORIGINAL TRANSCRIPT IS HEREBY FILED WITH THE ORDERING ATTORNEY BY MEANS OF PRIORITY MAIL, IN ACCORDANCE WITH THE NORTH CAROLINA RULES OF CIVIL PROCEDURE.

(DATE)

MICHAEL B. CARTER, NOTARY/REPORTER
NOTARY NUMBER 19960030065
MY COMMISSION EXPIRES FEBRUARY 15, 2021

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF NORTH CAROLINA
NORTHERN DIVISION
No. 2:15-CV-42-BO

RED WOLF COALITION,
DEFENDERS OF WILDLIFE, and)
ANIMAL WELFARE INSTITUTE,
)
Plaintiffs,
)
vs.
)
THE UNITED STATES FISH AND
WILDLIFE SERVICE; DAN ASHE, in his)
official capacity as Director of the
United States Fish and Wildlife Service;)
CYNTHIA K. DOHNER, in her official
capacity as Regional Director of the)
United States Fish and Wildlife
Service, Southeast Region,)
Defendants.)

DEPOSITION OF JOHN A. VUCETICH, JR., Ph.D.
(Taken by Defendants)
Chapel Hill, North Carolina
Tuesday, September 19th, 2017

APPEARANCES

ON BEHALF OF THE PLAINTIFFS:

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ALSO PRESENT:

Christina McClintock

DEPOSITION OF JOHN A. VUCETICH, JR., Ph.D., a witness called on behalf of Defendants, before Amy A. Brauser, Notary Public, in and for the State of North Carolina, at the law office of Southern Environmental Law Center, 601 West Rosemary Street, Chapel Hill, North Carolina, on Tuesday, the 19th day of September, 2017, commencing at 8:55 a.m.

* * * * * * * * *

INDEX OF EXAMINATIONS

INDEX OF EXHIBITS

NUMBER	DESCRIPTION	MARKED/IDENTIFIED
Exhibit 115	Defendants' Notice of Deposition of John Vucetich	34
Exhibit 116	Curriculum Vitae	42
Exhibit 117	Expert Report of John A. Vucetich, Ph.D.	66
Exhibit 118	The Challenges of Red Wolf Conservation and the Fate of an Endangered Species Recovery Program	228
Exhibit 119	Managing hybridization of a recovering endangered species: The red wolf Canis rufus as a case study Bates RWC 001313 to 327	251
Exhibit 120	Factors influencing red wolf-coyote hybridization in eastern North Carolina, USA Bates RWC 026301 to 309	274
Exhibit 121	Describing a developing hybrid zone between red volves and coyotes in eastern North Carolina, USA Bates RWC 026201 to 214	290

PREVIOUSLY MARKED EXHIBITS

Exhibit 83	Second Amended Complaint	323
Plaintiff's Exhibit 1	Wild Population Trends Bates USFWS-0013110	162
Plaintiff's Exhibit 4	Cause of death numbers Bates USFWS-0030933 to 934	176
Exhibit 78	Final Report for Fish and Wildlife Bates USFWS-0032568 to 629	351

you mean past --

Q. Poaching.

A. Poaching, yeah.

Q. In like a certain area or a certain location.

A. Yeah, yeah, yeah. Poaching is still very difficult to predict, and so -- and I think the difficulty of predicting it, and you know is it going to happen to that wolf, is -- is sufficiently difficult enough to predict myself that myself and my colleagues advised against it in the Mexican Wolf Recovery Plan, and I would advise against it in this case too.

Q. Let's move to problem wolves or wolves that present threats to human safety or life or property, as --

A. Yes.

Q. -- as we talked about. What's your opinion on how often there are actually problem wolves in a -- in a wild population of wolves?

A. In general or for red wolves?

Q. Let's start with general and then we can bring it down to red wolves, such as like a percentage or a proportion.

A. Yeah, let me offer you some information,

and tell me if it's helpful for answering the question.

Q. Okay.

A. One of the things that's included in a problem wolf is a problem wolf that actually kills a livestock, so that's an example of a problem wolf. And in the state of Michigan, wolves kill livestock maybe a dozen times a year. In other states, for example, out West, the Idaho, Montana, Wyoming, wolves might kill livestock maybe 100 times a year, something on that order, in each of those states in each year. So those -- those give some sense at a state level for how often problem wolves might occur.

And in the red wolf case, my understanding is -- and I learned this from one of the documents that were provided to me -- is that in the past approximately 25 years, there may have been ten such problem wolves. And this number 10 problem wolves includes, as I remember it, something like six wolves that actually were involved in confirmed depredation losses of -- I think they were all livestock, except for one might have been a pet. That's six. And then there were four instances where humans shot a wolf.

And from the report I was able to read, which was very brief and just a summary, there was

this kind of prima facie sense that the wolves that were shot by people were -- again, prima facie -- threatening either human safety or livestock. Whether deeper investigation would reveal otherwise is a separate story, but kind of prima facie in accepting all that, that gives ten -- ten instances of problem wolf behavior over a 25-year period. And so that is -- that's -- I mean, it's orders of magnitude lower than in the other states that I mentioned.

Q. Okay. And just to recap, you believe that problem wolves could be lethally taken or shot if they do engage in the problem behavior that you described?

A. Yeah, and so I think -- yeah, I think the -- the word you said "could" is important. And, I mean, my fuller view on that is that dealing with problem wolves, there are many ways to deal with a problem wolf, and so -- or several ways to deal with a problem wolf. One is to lethally control them, to kill them, and the other is to take nonlethal actions that might change their behavior.

And it's my sense that nonlethal methods sometimes work and sometimes they don't. And they're -- they may be more likely to work in some situations than in others. It's also been my view that when an agency, state or federal, has identified

Q. Is the wild population of red wolves critical to recovery of red wolves?

A. Absolutely critical. It's not possible to recover red wolves without there being a viable wild population.

Q. Why is the wild population of red wolves critical to red wolf recovery?

A. My understanding would be that the basic understanding of red wolf -- I'm sorry, the basic understanding of recovery is that there be a free-ranging wild population.

Q. Are there any unique benefits of a wild population of red wolves as opposed to captive red wolves?

A. The unique benefit is that it's almost certain, unquestionably certain that recovery requires there to be a wild population. That's unique, and there's no substitute for it. It's essential.

Q. How do wild red wolves compare to captive red wolves?

A. How do they compare in what sense?

Q. Do wild red wolves -- scratch that.

Do wild red wolves behave differently than captive red wolves?

A. Yes, there are important behavioral

differences here. When -- wild red wolves have experience avoiding trouble, avoiding trouble with other human beings that could lead to their being poached. Wild red wolves also have experience capturing wild prey. And those are things that are extremely important, vital, in fact, to the viability of a wild population, and those are properties that -- and behaviors that captive wolf -- or captive wolves have not necessarily acquired.

Q. All right. Looking at Exhibit 78, this is the Population Viability Analysis.

A. Okay. Yes.

Q. Could you turn to page 28?

A. Yes.

Q. Looking at that first numbered bullet point --

A. Number 1.

Q. Number 1.

A. Yes.

Q. -- what were the conditions or assumptions about the wild red wolf population for the baseline in this PVA?

A. Yes, the baseline model that they ran included the number of wolves that were in the population. It also included assumptions about

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E R R A T A   S H E E T

Case Name: Red Wolf Coalition, et al. vs. The United States Fish and Wildlife Service, et al.

DEPOSITION OF: JOHN A. VUCETICH, JR., Ph.D.

I, John A. Vucetich, Jr., Ph.D., certify that I have read my deposition, which was taken on the 19th day of September, 2017, and request that the following changes be made:

Page No.	Line No.	Change	Reason for Change
10	23	Change “depositions” to “declarations”	Wrong term
11	18	Change “correct” to “correctly”	Grammatical
12	6	Insert “that” after “animals,”	Missing word
17	18	Change “to our” to “are”	Wrong term
19	4	Change “a” to “the”	Wrong term
21	25	Capitalize “N” in “neanderthals”	Grammatical
27	6	Change “the hearing” to “my testimony”	Wrong term
27	7	Change “best the” to “the best”	Wrong word order
27	25	Change “account” to “count”	Wrong term
28	16	Insert “a” after “as”	Missing word
40	6	Change “We” to “Well I”	Wrong term
40	25	Change “referring” to “referring to”	Wrong term
43	5-6	Change “a lot of paragraphs were” to “about a paragraph or so”	Wrong term
55	23	Change “balloons” to “loons”	Wrong term
57	19	Change “interest” to “intersection”	Wrong term
60	4	Change “Society for Wildlife Management” to “Wildlife Society”	Wrong term
62	9	Change “I’m” to “it’s”	Wrong term
66	10	Change “parks” to “park”	Wrong term
73	1	Change “a counting” to “accounting”	Wrong term
74	3	Change “roll” to “role”	Wrong term
77	14	Insert “or elk” after “moose”	Clarification
78	14	Change “governments” to “government”	Wrong term
79	1	Change “fire” to “focus”	Wrong term
79	17	Change “two” to “200”	Wrong term
81	7	Change “to” to “two”	Wrong term
81	11	Change “two” to “200”	Wrong number
90	12	Change “they” to “we”	Wrong term

96	5	Insert “a” after “are”	Missing word
100	11	Insert “I” before second instance of “would”	Missing word
100	24	Change “stayed hunted” to “started hunting”	Wrong term
107	19	Change “for a bull-like” to “a bowling”	Wrong term
114	7	Change “it’s” to “its”	Grammatical
118	25	Change “relatively few” to “a relatively small”	Wrong terms
119	16	Change “able” to “unable”	Wrong term
119	25	Insert “at” after “mean,”	Missing word
123	21	Change “model” to “models”	Wrong term
127	15	Delete “ -- ” between “take” and “authorization”	Wrong term
144	6	Insert “that” after “has”	Missing word
146	21	Change “varmints” to “marmots”	Wrong term
147	24	Change “saying” to “studying”	Wrong term
151	6	Change “recovery” to “recovered”	Wrong term
162	3	Delete “for”	Wrong term
162	5	Change “or” to “of”	Wrong term
163	3	Insert “to” after “according”	Missing word
164	11	Delete “to”	Grammatical
165	16	Delete “plausibly”	Wrong term
166	20	Change “along” to “add”	Wrong term
169	13	Delete second instance of “is”	Wrong term
184	5	Change “we’ll” to “I’ll”	Wrong term
186	9	Delete “on”	Wrong term
191	1	Insert “(indicating)” after “here.”	Missing description
193	8	Insert “be” after “can”	Missing word
193	10	Insert “the” before “indication”	Missing word
196	3	Delete “of”	Wrong term
199	5	Insert “with” after “associated”	Missing word
199	21	Change “arise” to “arises”	Wrong term
202	17	Insert “a” after “but”	Missing word
204	11	Change “wolfs” to “wolves”	Wrong term
205	16	Insert “the” after “making”	Missing word
205	20	Delete “to”	Wrong term
205	25	Change “that’s” to “is”	Wrong term
210	1	Change “included” to “includes”	Wrong term
210	6	Delete “not”	Wrong term
210	16	Change “particularly” to “particular”	Wrong term
218	1	Change “included” to “includes”	Wrong term
218	19	Insert “active” before “adaptive”	Missing word
222	14	Insert “is” after “this”	Missing word
227	11	Change “type” to “that”	Wrong term
234	16	Change “specie” to “species”	Wrong term
239	7	Change “was” to “is”	Wrong term
240	20	Delete first instance of “some”	Wrong term

241	4	Change “Way” to “Waite”	Wrong name
244	19	Change “documents” to “document”	Wrong term
249	4	Change “it’s” to “it”	Wrong term
259	24	Change “liters” to “litters”	Wrong term
269	21	Change “a” to “an”	Grammatical
273	15	Change “implied” to “been applied”	Wrong term
288	19	Change “is” to “in”	Wrong term
291	12	Insert “of” after “belief”	Missing word
329	6	Change “there’s layer of release” to “that’s later released”	Wrong terms
331	23	Change second instance of “I” to “they”	Wrong word
333	8	Change “to” to “by”	Wrong word
333	12	Insert “the” after “in”	Missing word
334	20	Change “died to “dying”	Wrong term
341	10	Change “cases” to “case”	Wrong term
345	10	Delete first instance of “myself”	Wrong term
365	7	Change “that” to “than”	Wrong term
366	16	Insert “a” after “whereby”	Missing word
372	20	Insert “there’s” after “But”	Missing word
373	7	Change “wolves” to “human families”	Wrong term
373	9	Change “population” to “pack”	Wrong term
381	1	Change “and” to “in”	Wrong term

31 Oct 2017

Signature　　　　　　　　Date

S I G N A T U R E   P A G E

IN RE: Red Wolf Coalition vs. U.S. Fish and Wildlife Service

DEPOSITION OF: JOHN A. VUCETICH, JR., Ph.D.

I, JOHN A. VUCETICH, JR., Ph.D., do hereby certify that I have read the foregoing deposition and that the foregoing transcript is a true and correct record of my testimony, subject to the attached changes, if any, on the amendment page.

John A. Vucetich Jr.

JOHN A. VUCETICH, JR., Ph.D.

Subscribed and sworn to before me,

this 31st day of October, 2017.

Beverly Smith

NOTARY PUBLIC

My Notary Seal Expires:

BEVERLY SMITH
Notary Public, State of Michigan
County of Houghton
My Commission Expires 01-14-2018
Acting in the County of Houghton

DEPARTMENT OF AGRICULTURE

48 CFR Part 433

[Agriculture Acquisition Circular No. 1]

Acquisition Regulation; Competition in Contracting and Miscellaneous Changes; C[illegible]on

AGENCY: [illegible] Op[illegible]tions, USDA.

ACTION: Final rule; correction.

SUMMARY: This document corrects a final rule, which was published in the **Federal Register** on Monday, September 29, 1986 (51 FR 34564) to amend Agriculture's Acquisition Regulation (AGAR) for the purpose of implementing the Competition in Contracting Act of 1984 and inserting other additions, deletions, and revisions.

EFFECTIVE DATE: September 29, 1986.

FOR FURTHER INFORMATION CONTACT: Larry Schreier, Office of Operations, United States Department of Agriculture, Washington, DC, (202) 447-8924.

SUPPLEMENTARY INFORMATION: In FR Doc. 86-21954 published Monday, September 29, 1986, make the following correction in order to remedy an inadvertent deletion of existing sections of text, which should have been redesignated as sections under Subpart 432.2:

1. On page 34566, the instruction for item 17 is corrected to read as follows:

"17. Part 433 is amended to read as follows by:

(a) revising the Table of Contents; (b) adding Subpart 433.1 consisting of sections 433.102 through 433.105; (c) redesignating sections 433.003, 433.003-70, 433.009, 433.011, and 433.012 as sections 433.203, 433.203-70, 433.209, 433.211, and 433.212, respectively and designating the redesignated sections as subpart 433.2; (d) revising the FAR cross-referenced section numbers 33.003, 33.009, and 33.011(a)(4) as shown in the text of redesignated sections 433.203(a), 433.209, and 433.211 to read as 33.203, 33.209, and 33.211(a)(4), respectively; and (e) revising the AGAR cross-referenced section number 433.003-70 shown in the text of redesignated section 433.211 to read as 433.203-70."

List of Subjects in 48 CFR Part 433

Government procurement; Protests, Disputes, & Appeals.

Dated: November [illegible]

Charles A. Bucy

Acting Director

[FR Doc. 86-2[illegible] 11-18-86; 8:45 am]

BILLING CODE [illegible]

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

Endangered and Threatened Wildlife and Plants; Determination of Experimental Population Status for an Introduced Population of Red Wolves in North Carolina

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: The U.S. Fish and Wildlife Service determines that it will introduce mated pairs of red wolves (*Canis rufus*) into the Alligator River National Wildlife Refuge (Refuge) in Dare County, North Carolina. The red wolf population in Dare County and the adjacent Tyrrell, Hyde, and Washington Counties is determined to be a nonessential experimental population according to section 10(j) of the Endangered Species Act of 1973 (ESA), as amended. The red wolf is now extirpated from its entire historic range in the southeastern United States; this action is being taken in an effort to reestablish a wild population. The experimental population status is designated because section 10(j) authorizes more discretion in devising an active management program for an experimental population than for a regularly listed species, a critical factor in insuring that other agencies and the public will accept the proposed reintroduction. An experimental population is treated as a threatened species for purposes of sections 4(d) and 9 of the Act, which prohibit certain activities involving listed species. Accordingly, a special rule for specifying circumstances under which taking of introduced red wolves will be allowed is being promulgated in conjunction with the nonessential, experimental population rule. Management actions that would involve take include recapture of wolves to replace transmitter or capture collars, provide routine veterinary care, return animals to the refuge which have strayed outside its boundaries, or to return to captivity animals that are a threat to human safety or property, or which are severely injured or diseased. The nonessential designation is determined because the species is fully protected in captivity in six different locations, and all animals released into the wild can be quickly replaced through captive breeding. When not on National Wildlife Refuge or National Park lands, a nonessential experimental population is treated as a proposed species, rather than a listed species, for purposes of the review of other Federal agency actions under section 7 of the ESA (except for section 7(a)(1), which applies to all experimental populations). No conflicts are envisioned between the red wolf reintroduction and any existing or anticipated Federal agency actions or traditional public uses of the refuge or surrounding lands.

DATES: The effective date of this rule is December 19, 1986. Although red wolves will be transported to North Carolina prior to the effective date, no wolves will be released until next spring, well after this final rule becomes effective.

ADDRESSES: The complete file for this rule is available for inspection, by appointment, during normal business hours at the Endangered Species Field Office, 100 Otis Street, Room 224, Asheville, North Carolina 28801.

FOR FURTHER INFORMATION CONTACT: Mr. Warren T. Parker, Asheville Endangered Species Field Supervisor (see **ADDRESSES** section above), or Mr. Marshall P. Jones, Chief, Endangered Species Division, U.S. Fish and Wildlife Service, 75 Spring Street, SW., Atlanta, Georgia 30303 (404/331-3580 or FTS 242-3580).

SUPPLEMENTARY INFORMATION:

Background

Among the signficant changes made by the Endangered Species Act Amendments of 1982, Pub. L. No. 97-304, was the creation of a new section 10(j) which provides for the designation of specific introduced populations of listed species as "experimental populations." Under previous authorities in the Act, the Service was permitted to reintroduce populations into unoccupied portions of a listed species historic range when it would foster the conservation and recovery of the species. Local opposition to reintroduction efforts, however, stemming from concerns about the restrictions and prohibitions on private and Federal activities contained in sections 7 and 9 of the Act, severely handicapped the effectiveness of this as a management tool. Under section 10(j), past and future reintroduced populations established outside the current range, but within the species' historic range, may now be designated, at the discretion of the Service, as "experimental." Such designations will increase the Service's flexibility to manage these reintroduced populations because such experimental populations may be treated as threatened species. The Service has much more discretion in devising management programs for threatened species that for endangered species, especially on matters regarding

incidental or regulated takings. Morever, experimental populations found to be "nonessential" to the continued existence of the species in question are to be treated as if they were only proposed for listing for purposes of section 7 of the ESA, except as noted below. A "nonessential" experimental population is not subject to the formal consultation requirement of section 7(a)(2) of the Act, but if the experimental population is found on a National Wildlife Refuge or National Park, the full protection of section 7 applies to such animals. (The provision in section 7(a)(1) applies to all experimental populations.) The individual organisms comprising the designated experimental population can be removed from an existing source or donor population only after it has been determined that their removal itself is not likely to jeopardize the continued existence of the species, and must be done under a permit issued in accordance with the requirements in 50 CFR 17.22.

The species included in this final rule is the red wolf (*Canis rufus*), an endangered species which is currently extirpated from the wild. The red wolf was originally native to the southeastern United States from the Atlantic Coast westward to central Texas and Oklahoma and from the Gulf of Mexico to central Missouri and southern Illinois. The historic relationship of the red wolf to other wild canids is poorly understood, but it is thought that the red wolf coexisted with the coyote (*Canis latrans*) along its western range generally along the line where deciduous cover gave way to open prairie in Texas and Oklahoma. The gray wolf (*Canis lupus*) is believed to have frequented the range north of the red wolf, but probably did range along higher elevations of the Appalachian Mountains as far south as Georgia and Alabama. Historical evidence seems to characterize the red wolf as common in the vast pristine bottomland riverine habitats of the southeast, and especially numerous in and adjacent to the extensive "canebrakes" that occurred in these habitats. The canebrakes harbored large populations of swamp and marsh rabbits, considered likely to be the primary prey species of the red wolf under natural conditions. The demise of the red wolf was directly related to man's activities, especially land changes, such as the drainage of vast wetland areas for agricultural purposes; the construction of dam projects that inundated prime habitat; and predator control efforts at the private, State, and Federal levels. At that time the natural history of the red wolf was poorly understood, and like most other large predators, it was considered a nuisance species. Today, the red wolf's role as a potentially important part of a natural ecosystem, if it can be successfully reintroduced, is better appreciated. Furthermore, it is now clear that traditional controls would not be needed in any case; the red wolf would pose no threat to livestock in situations where its natural prey, especially such small mammal species as rabbits and opossums, are abundant. Service studies have documented that there is an abundant prey base at the Alligator River National Wildlife Refuge. This was one of the criteria used to select it as a reintroduction site.

Man-caused pressures eventually forced the red wolf into the lower Mississippi River drainage and lastly into southeast Texas and southwest Louisiana. This was where the only surviving population remained in the mid-1970s when the Service decided to trap the animals and place them in a captive breeding program. This decision was based on the obviously low number of animals left in the wild, poor physical condition of these animals due to internal and external parasites and disease, and the treat posed by an expanding coyote population and consequent inbreeding problems. A Red Wolf Captive Breeding Program was established by contract with the Paint Defiance Zoological Garden of the Metropolitan Park Board of Tacoma, Washington. Soon, thereafter, 40 wild-caught adult red wolves were provided to the breeding program, and the first litter of pups was born in May 1977. Since then, the wolves have continued to prosper at this and six other captive facilities throughout the United States. Without this extreme action it is obvious that the species would now be completely extinct. Throughout this time, however, the goal of the Service's red wolf recovery program has continued to be the eventual release of at least some of the captive animals into the wild to establish new, self-sustaining populations.

To demonstrate the feasibility of such reintroductions of red wolves, the Service conducted carefully planned experiments in 1976 and 1978. These experiments involved the release of mated pairs of red wolves onto Bulls Island, a 4,000-acre component of the Cape Romain National Wildlife Refuge near Charleston, South Carolina. The results of these planned releases indicated that it is feasible to reestablish adult wild-caught red wolves in selected habitats in the wild. The experiments were eventually terminated, and the wolves recapturec and returned to captivity all in good health. Bulls Island was not large enough to support a self-sustaining population of wolves, and it was neve intended to be a permanent reintroduction site. Observations and conclusions derived from these experiments, plus knowledge gained with wild-caught but captive-reared pups in Texas, also indicate the potential success of establishing capti reared populations in the wild.

Based on limited historical knowled of this species, it is believed that the r wolf would thrive in dense cover typified by large acreages of bottomla vegetation now typically found in remnant sites throughout the Piedmon and Coastal Plain regions of the southeastern States. Such sites would provide the small mammal prey base and the denning and escape cover required by the species. Ideally such areas would also be isolated, have a l human encroachment potential, and b secured in either State or Federal ownership.

A great deal of investigative effort l the Fish and Wildlife Service since 19 has been directed at locating suitable release sites throughout the historic range of the red wolf. Apparently ide habitat for this species exists within t Alligator River National Wildlife Refu in Dare and Tyrrell Counties, North Carolina. This refuge comprises nearl 120,000 acres of the finest wetland ecosystems found in the Mid-Atlantic region. Principal natural communities the Refuge include broad expanses of palustrine (non-riverine) swamp fores pocosins, and freshwater and salt marshes. Adjacent to the refuge is a 47,000-acre U.S. Air Force bombing range with similar habitats. The very limited live ordnance expended by th Air Force and Navy on this range is restricted to two extremely small, we defined, and cleared target areas (approximately 10 acres each). The establishment of an experimental population of red wolves in this refug will greatly enhance the recovery of t species by demonstrating the feasibil of a large predator reintroduction. Th approved Red Wolf Recovery Plan ca for the establishment of three self-sustaining populations before the species can be considered for possibl downlisting from its endangered statu By demonstrating that reintroduction red wolves into suitable habitats is feasible, the Service hopes to encour other Federal land management agencies in the Southeast to become interested in further reintroduction efforts.

Presently, the Fish and Wildlife Service's Red Wolf Captive Breeding Program in Washington State has 49 animals. One small captive breeding program near St. Louis, Missouri, has 12 wolves, and 19 other animals are in five public and private zoos in the United States. The Fish and Wildlife Service has full responsibility for all of the red wolves in captivity, and from this captive group will come those animals selected for a reintroduction. A reintroduction project at the refuge requires the removal of 8 to 12 animals from the captive program over a period of 12 months. Animals selected for reintroduction to the wild will be flown to Norfolk, Virginia, in the fall and transported by truck to the refuge. Each pair will be placed in a 2,500-square foot acclimation pen for a period of six months. Acclimation pens will be isolated and provided maximum protection. During their acclimation each animal will be fitted with a radio collar and a capture collar to allow the animals time to adjust to the collars and also to insure the quick retrieval of any animals if this proves necessary.

During the early spring months of 1987, three pairs of mated, acclimated red wolves will be released on a 2-week staggered schedule. They will be closely monitored via telemetry tracking for the first 4 to 6 weeks, then the frequency of monitoring will be gradually reduced after each pair has established a home range on the refuge. If these initial releases are judged successful, two more mated pairs will be released on the refuge the following spring (1988) after going through the acclimation process. It is anticipated that the refuge and adjacent U.S. Air Force lands could eventually sustain a red wolf population of about 25 to 35 animals.

Status of Reintroduced Populations

This reintroduced population of red wolves is designated as a nonessential experimental population according to the provisions of section 10(j) of the Act. The experimental population status means the reintroduced population will be treated as a threatened species, rather than an endangered species, for the purposes of sections 4(d) and 9 of the Act, which regulate taking, and other actions. This enables the Service to adopt a special rule which is less restrictive than the mandatory prohibitions covering endangered species, if there is a management need for more flexibility and the resulting protections are necessary and advisable for the conservation of the red wolf. The Service recognizes that circumstances could arise whereby a person engaged in an otherwise lawful activity such as hunting or trapping, might accidently take a red wolf despite the exercise of reasonable due care. Where such a taking was unavoidable, unintentional, and did not result from negligent conduct lacking reasonable due care, the Service believes that no legitimate conservation purpose would be served by bringing an enforcement action under the ESA. Therefore, upon investigation of a taking, the Service would not prosecute anyone under such circumstances. In addition, red wolves can be taken in defense of human life (though such circumstances are considered extremely unlikely to occur), provided the taking is immediately reported to the Refuge Manager. Service and State employees and agents would be additionally authorized to take animals which are responsible for depredations to livestock or property by means which might involve injury or death only if it has not been possible to eliminate such threat by live capturing and releasing the red wolf unharmed on the refuge. These flexible rules are considered a key to public acceptance of the reintroduced population. The State of North Carolina has regulatory authority to protect and conserve the species, and we are satisfied that the State's regulatory system for recreational activities is sufficient to provide for conservation of the red wolf. No additional Federal regulations are needed.

The nonessential status is appropriate for the following reasons: Although extirpated from the wild, the red wolf, nevertheless, is secured in seven widely separate captive breeding programs and zoos in the United States. The existing captive population totals 80 animals, with over half this number in the U.S. Fish and Wildlife Service's captive breeding program in the State of Washington, and the other animals scattered in six facilities in Louisiana, Texas, Missouri, Florida, and New York. Given the health checks and careful monitoring that these animals receive, it is highly unlikely that disease or other natural phenomena would threaten the survival of the species. Furthermore, the species breeds readily in captivity; only five members of the existing captive population were wild caught, with all the others born since 1977 to captive pairs. Therefore, the taking of 8 to 12 animals from this captive assemblage would pose no threat to the survival of the species even if all of these animals, once placed in the wild, were to succumb to natural or man-caused factors.

The management advantage from the nonessential status comes from the fact that it would change the application of section 7 of the Act (interagency consultation) to the reintroduced population. Off of the refuge (*i.e.*, on the Dare County Bombing Range or on private lands), the nonessential experimental population would be treated as if it were a species proposed for listing, rather than a listed species. This means that only two provisions of section 7 would apply on these non-Service lands: Section 7(a)(1), which authorizes all Federal agencies to establish conservation programs; and section 7(a)(4), which requires Federal agencies to confer informally with the Service on actions that are likely to jeopardize the continued existence of the species. The results of a conference are only advisory in nature; agencies are not required to refrain from commitment of resources to projects as a result of a conference. There are in reality no conflicts envisioned with any current or anticipated management actions of the Air Force or other Federal agencies in the area. The presence of the bombing range is in fact a benefit, since it forms a secure buffer zone between the refuge and private lands; the target areas that are actually fired into, as previously discussed, would be easily avoided by the wolves. Thus there would be no threats to the success of the reintroduction project or the overall continued existence of the red wolf from these less restrictive section 7 requirements.

On the Alligator River National Wildlife Refuge, on the other hand, the experimental population would continue to receive the full range of protections of section 7. This would prohibit the Service or any other Federal agency from authorizing, funding, or carrying out an action on the refuge which is likely to jeopardize the continued existence of the red wolf. Service regulations at 50 CFR 17.83(b) specify that section 7 provisions shall apply collectively to all experimental and nonexperimental populations of a listed species, rather than solely to the experimental population itself. The Service has reviewed all ongoing and proposed uses of the refuge, including traditional trapping and hunting with or without dogs, and found that none of these would jeopardize the continued existence of the red wolf, nor would they adversely affect the success of the reintroduction effort.

Location of Reintroduced Population

Since the red wolf is recognized as extinct in the wild, this reintroduction site fulfills the requirement of section 10(j) that an experimental population be

geographically isolated and/or easily discernible from existing populations. As previously described, the release sites are in the Alligator River National Wildlife Refuge in Dare County, North Carolina, in the extreme northeast corner of the State, just inland from the Outer Banks. The experimental population designation is also being extended to Tyrrell County (which includes a small portion of the Refuge lying west of the Alligator River) as well as the adjacent Washington and Hyde Counties.

Management

This reintroduction project will be undertaken by the Service. Present plans call for the acclimation of wolves for 6 months in captive pens on the refuge, followed by release of six animals in the spring of 1987, and if that is successful, by the release of two additional pairs the next spring. Animals released will be adult, previously mated pairs. Releases will be staggered at 2-week intervals. Reintroduced animals will be closely monitored via telemetry during the first 3 to 5 weeks following release. After this initial monitoring phase, periodic checks will be made to determine if established home ranges are being maintained. It is anticipated that, because of the size and habitat characteristics of the reintroduction area, animals will remain within the boundaries of the refuge and adjacent military lands. The public will be instructed to immediately report any observation of a red wolf off Federal lands to the refuge manager. The Service will then take appropriate actions to recapture and return the animal to the refuge.

Take of animals by the public will be discouraged by an extensive information and education program and by the assurance that all introduced animals will be radio-collared and, thus easy to locate if they leave the refuge. The public will be encouraged to cooperate with the Service in attempts to maintain the animals on the release site. In addition, there will be no penalty for taking a red wolf where the take, incidental to an otherwise lawful activity was unavoidable, unintentional, and did not result from negligent conduct lacking reasonable due care, provided the taking is immediately reported to the refuge manager. Service and State employees and agents would be additionally authorized to take animals which need special care or which are responsible for depredation to livestock or property only if it has not been possible to eliminate such threat by live capturing and releasing the specimen unharmed on the refuge. Take procedures in such instances would involve live capture and removal to a remote area, or if the animal is clearly unfit to remain in the wild, return to the captive breeding facility. Killing of animals would be a last resort; lethal takes are authorized only if live capture attempts failed or there was some clear danger to human life. These flexible rules are considered a key to public acceptance of the reintroduced population.

Utilizing information gained from this initial 5-year period, an overall assessment of the success of the reintroduction will be made at the end of the fifth year. This assessment will include public meetings in the Dare County area to ascertain public attitudes that have developed toward the red wolf. In consultation with the North Carolina Wildlife Resources Commission, a determination will then be made regarding the future management of wolves that leave the refuge/bomb range area. This assessment will provide the Service the information needed to initiate the next management phase for the Alligator River population and to consider additional red wolf introductions in accordance with the recovery goals identified for this species.

This reintroduction is not expected to conflict with existing or proposed human activities or hinder the utilization of the Alligator River National Wildlife Refuge by the public. Additionally, the presence of these animals is not expected to impact the ongoing activities designated for this national wildlife refuge. Utilization of the refuge for the establishment of a red wolf population is consistent with the legal responsibility of the Service to enhance the wildlife resources of the United States.

As described above, no extant populations are available to provide animals for this reintroduction. Therefore, the Service believes that this reintroduction will result in the establishment of the only viable wild population. With a successful reintroduction, the Service can begin to consider additional sites and proceed with the expectation that recovery of this species is attainable. In addition, there are no existing or anticipated Federal and/or State actions identified for this release site which are expected to affect this experimental population. For all of these reasons, the Service finds that the release of an experimental population of red wolves will further the conservation of this species. *See* ESA, section 10(j)(2)(A); 50 CFR 17.81(b).

On July 24, 1986, the Service published, in the **Federal Register** (51 FR 26564), a proposal to introduce mated pairs of red wolves into the Alligator River Refuge and to determine this population to be a nonessential, experimental population according to section 10(j) of the Endangered Species Act of 1973 (ESA), as amended. That proposal provided information on the species' biology, status, and recovery potential, as well as possible implications of reintroducing the red wolf to the refuge.

Summary of Comments and Recommendations

In the July 24, 1986, proposed rule (51 FR 26564) all interested parties were requested to submit comments that might contribute to the development of a final decision on the proposed rule. Appropriate State and Federal agencies, scientific and environmental organizations, and other interested parties were contacted and requested to comment. A 45-day comment period was provided. A total of 12 letters were received. Specific issues addressed by the commenters and the Service response to each are presented below.

1. General Comments of Support

The Edison Electric Institute commented that they support the reintroduction effort and expressed the opinion that the red wolf project should be a model for reintroduction of other endangered species.

The Tennessee Valley Authority expressed their support for the reintroduction, stressing the importance of the 1982 Amendment to the Endangered Species Act which allows for the experimental designation of animals selected for reintroduction.

The Secretary of the North Carolina Department of Natural Resources and Community Development expressed his agency's support for the project and underscored his view that the effort will provide not only a positive impact on the preservation of the red wolf, but also a greater goal, which is education. His letter went on to underscore the vital role that captive environments such as zoos can play in the preservation of species. The importance of captive programs in many endangered species endeavors was also voiced by the American Association of Zoological Parks and Aquariums and by the Point Defiance Zoo and Aquarium in Tacoma, Washington.

Response: The Service strongly concurs with the key role of zoos and other captive breeding programs in endangered species management, and

the importance of the experimental population provisions added to the Act in 1982 in fostering endangered species conservation.

2. Comments Concerning Taking of Red Wolves

The Defenders of Wildlife, the National Audubon Society, The Humane Society of the United States and the National Wildlife Federation each expressed strong support for the proposal, but objected to the proposed incidental take provision as being both unnecessary and subject to misinterpretation. These organizations shared the view that this language could be construed to mean that the Service would invite or condone the indiscriminate killing of red wolves.

Response: After reconsideration of this issue, the Service agrees that the language in the proposed special rule is difficult to interpret, although the coverage of the incidental take exception in proposed § 17.84(c)(4)(i) was clearly intended by the Service to be limited to unintentional taking that results from otherwise lawful recreational activities. The Service did not intend to allow indiscriminate killing of red wolves through the language of its proposed rule. Nevertheless, to avoid any possible confusion, the special rule has been revised to delete this language. Instead, the enforcement policy of the Service with regard to the accidental taking of a red wolf has been clarified in the preamble to this final rule (see "Background" section). In essence, there will be no penalty where the take of a red wolf, incidental to an otherwise lawful activity, was unavoidable, unintentional, and did not result from negligent conduct lacking reasonable due care, provided the taking is immediately reported to the refuge manager.

The Wildlife Information Center requested that only live traps be used should it be necessary for the Service to remove wolves from the project area.

Response: The Service will make every effort to keep red wolves on the refuge, but if an animal leaves the refuge/bombing range area, the Service intends to recapture it and return it to captivity, utilizing the capture collar that each animal will wear upon release. Upon receiving a coded radio signal, this collar is activated, the wolf is sedated, and then the animal is located by radio transmitter signal. Should the capture collar fail, individual animals would be tracked by transmitter and darted utilizing a standard gas powered capture gun. The use of live traps in this particular habitat type, coupled with a high black bear population, would be cost prohibitive and inefficient. A basic premise adopted by the Service for this project is that when a red wolf must be recaptured, it should be done as quickly and humanely as possible.

The North Carolina Farm Bureau stated that livestock owners should be allowed to take red wolves that are engaged in livestock depredation, rather than having to wait for a Fish and Wildlife Agent or State Wildlife Conservation Officer to prove that depredations were actually occurring.

Response: Since an ample prey base exists on the refuge/bomb range area, the Service sees very little likelihood of conflicts with the small amount of livestock which exists in Dare County. In the unlikely event one or more red wolves should stray far enough from the refuge to encounter livestock, the Service would ask that local farmers immediately contact the refuge manager. However, if one or more red wolves are actually preying on livestock, Service or State employees would be empowered to take the offending animals. Furthermore, nothing in the proposed rule was intended to interfere with a livestock owner actually protecting his property from other predators such as wild dogs, which are a much more probable threat than red wolves.

3. Comments Concerning Hunting and Trapping on the Refuge

The Executive Director of the North Carolina Wildlife Resources Commission expressed the support of his agency for the project so long as traditional hunting and trapping on the refuge is permitted.

The Humane Society of the United States expressed opposition to hunting and trapping on the refuge after red wolves are released. Similarly, the Wildlife Information Center stated that since the Service could not guarantee that red wolves will not be shot or accidentally trapped, all hunting and trapping should be prohibited.

The Defenders of Wildlife cautioned that the Service may have been premature to judge that no traditional uses of the refuge would jeopardize the wolves or interfere with the success of the project.

Response: The Service's underlying philosophy regarding the compatibility of the red wolf reintroduction and traditional recreational uses of the refuge is based on both immediate and long-term conservation needs. First of all, the whole intent of the experimental population provision of the Act is to eliminate the requirement for absolute protection of reintroduced animals, in order to foster the chances of reintroduction. The insistence of a guarantee that no animals will ever succumb to man-caused factors could preclude the use of this innovative provision of the Act. Without management flexibility, the current reintroduction effort would be much less likely to succeed. The Service's second premise deals with the long-term prospects this species has for recovery in the wild. The recovery plan calls for establishment of three self-sustaining populations before the species can be considered for possible downlisting. If traditional uses of the refuge have to be significantly modified or altered to accommodate red wolves, it is going to be very difficult, if not impossible, to approach other public land management agencies to permit wolf reintroductions on their lands. The best information indicates that known uses such as hunting and trapping are compatible with red wolf introduction. As information is gathered during the monitoring of released wolves, we will continue to evaluate the compatibility of these uses with the needs of the red wolf and make appropriate determinations.

4. Comments Regarding Removal of Wolves From the Captive Population

The Wildlife Information Center expressed concern over the number of red wolves (8–12) proposed for removal from the total captive population of 63 animals; they suggested that no more than six captive red wolves be selected for the project.

The National Wildlife Federation expressed a related concern that the Service may be overoptimistic in concluding that all animals can be quickly replaced through captive breeding, since it has taken 10 years to build up the current captive population; they urged the Service to minimize losses of released wolves rather than to rely on supplementing the reintroduced population with additional captive red wolves.

Response: The Service is confident that any wolves lost in the reintroduction attempt at Alligator River Refuge can be replaced in the next breeding season. The Service currently plans to limit releases to no more than 12 animals. This number is based on a proportion of the predicted eventual population the area will sustain (25 to 35 animals of all age classes), which in turn reflects the magnitude of the available prey base, the acreage available to the project, and the approximate home range of the animals, as determined in Texas and Louisiana during the late 1970s by radio telemetry investigations. The reproductive vigor of the red wolf has been amply demonstrated at the

Services' captive breeding project in Washington State and at other captive facilities; in fact, since publication of the proposed rule, the captive breeding program has produced 17 additional offspring, bringing the present captive population to 80 red wolves in the program nationwide. Furthermore, the overall captive population size could be even greater, except that it has been necessary to suppress reproduction in order to keep numbers within the capability of current facilities. Thus the Service has carefully evaluated the numerical status of this species and has determined that the taking of 8 to 12 animals from this captive assemblage would pose no threat to the survival of the species, even if all of these animals succumb to natural or man-caused factors.

5. Comments on Ecological Suitability of the Refuge to Support Red Wolves

The President of the North Carolina Farm Bureau Federation stated his view that "... the introduction of another predator into the refuge would be a mistake, and that the impact that this would have on other wildlife populations in the area (such as black bears) has not been fully considered." The American Farm Bureau similarly noted that there has been no determination of the effects of the red wolf reintroduction "... on all wildlife and plants within the 'food chain.' "

Response: Although little factual data is available regarding the interactions of red wolves and black bears, there is abundant evidence that black bears and gray wolves coexist in harmony in Minnesota and throughout Canada and Alaska. More generally, based on previous trial releases of red wolves in South Carolina in 1976 and 1978 and on the limited historical knowledge of the species in Louisiana and Texas, the Service does not expect the red wolf to disrupt any of the dynamic natural process on the refuge. During the 6-month acclimation period, surveys of pre-release biomass will be conducted in various habitat types on a per acre basis. After the wolves are released, these surveys will be duplicated and trends, if any, determined.

The American Farm Bureau expressed concerns that the Service had no data, but had only made a guess, about whether there is an adequate prey base to support a population of red wolves on the refuge. It also questioned whether the refuge is within the historic range of the red wolf and whether the habitat is suitable for the species, requesting the Service to specify how much of the total acreage is actually usable.

Response: The Service has conducted extensive small mammal surveys on portions of the refuge, especially in habitats that appeared to sustain a low density of probable prey species, such as the large acreage of pond pine pocosin north of U.S. 64. This habitat type was found to sustain at least moderate populations of white-footed and golden mice, southeastern shrews, marsh rabbits, and gray squirrels. This area is also inhabited by a fair population of bobcats. Other portions of the refuge tend to have more edge effect and thus carry higher populations of marsh rabbits and a variety of other small mammals which would serve as a substantial prey base for the red wolf.

Regarding historic range of the species, current investigations have determined that the red wolf occurred within recent historic time as far north along the Atlantic seaboard as Delaware and southeastern Pennsylvania. In terms of habitat suitability, the limited available historical information indicates the red wolf preferred areas with thick understory. In earlier times these were overflow river swamps with extensive canebrakes and associated vegetation. Habitats found within the Alligator River Refuge typify this habitat type to a large degree. About 70 percent of the refuge is made up of impenetrable pocosins of various types, and 20 percent or so is fresh water swamp habitat along the Alligator River. The remaining habitat of the refuge is made up of a pine ridge, roads, streams, and small clearings. The Service expects the red wolf to utilize all of these habitats but primarily to utilize the thick pocosins, which total more than 100,000 acres in the refuge/bombing range complex.

6. Comments on Documentation and Public Notification of the Proposal

The American Farm Bureau objected to the fact that the Service has not prepared a "legally sufficient biological assessment" for the project.

Response: The Service believes that the Farm Bureau has misunderstood the nature of such a document. Under 50 CFR 402.12(b)(1) [see 51 FR 19926, 19960 (June 3, 1986)] a biological assessment must be prepared for any Federal action that is a major *construction* activity prior to entering into consultation under section 7(a)(2). Such a document has no relationship to the process of designating an experimental population or reintroducing red wolves under section 10(j) of the Act, because the establishment of *this* experimental population does not involve construction activities that fall within the definition of "major construction activity," nor does this rule constitute a "major Federal action" for purposes of the National Environmental Policy Act. See 50 CFR 401.02 [51 FR 19926, 19958 (June 3, 1986)]. If the Farm Bureau's intent was to refer to general biological studies of the suitability of the area, the Service reviewed all available information on refuge habitats and red wolf habits, conducted studies of the prey base on the refuge, and consulted wolf experts prior to preparation of the proposal, to insure that there is a scientific consensus that the refuge is indeed suitable for a red wolf reintroduction. These are documented in the Service's technical proposal.

The American Farm Bureau went on to express the opinion that the Service had not adequately considered State and local laws and the impact on local agricultural interests. It also stated that the draft environmental assessment should have received wider distribution to possible affected agencies and agricultural interests within the State.

Response: The project has been carefully reviewed at various levels within the State government of North Carolina. The Wildlife Resources Commission has been aware of the proposal from its inception, and the project has been presented twice in detail to the wildlife commissioners at scheduled meetings with agendas publicized in advance. The Service consulted in detail with the North Carolina Commissioner of Agriculture and with other staff of the State Department of Agriculture. Staff of the Animal and Plant Health Inspection Service of the Federal Department of Agriculture (which is responsible for animal damage control activities) were likewise consulted. At the local level the Dare County Commission [illegible] reviewed the proj[illegible] to support the prop[illegible] local entity has advis[illegible] any laws that this proposal would violate. Regarding the environmental assessment, the announcement of its availability was included in the proposed rule, copies of which were provided to numerous interested parties throughout the State. Two requests for copies of the environmental assessment were received, and copies were provided. As noted elsewhere in this rule, the Service has determined that this action is not a major Federal action necessitating the preparation of an Environmental Impact Statement.

7. Other Red Wolf Protection Issues

The National Wildlife Federation also urged the Service to closely monitor the

wolves and their offspring for diseases, such as distemper and canine parvo virus, that can be transmitted to the wolves from domestic dogs on the refuge; expressed concerns about releases of deer dogs near red wolf acclimation-release sites during the hunting season; and suggested that speed limit warning signs and "rumble strips" be installed on portions of State Highways 64 and 264 within the refuge to alert motorists of the possible presence of red wolves in the area.

Response: The Service agrees with the intent of each of these comments. Close monitoring of wolves and their offspring for diseases, injuries, behavioral abnormalities, and other problems will be a routine part of the reintroduction. Access to the acclimation/release site areas will be limited within a one-half mile radius of each site. Regarding measures to limit speeds on highways, the Service agrees conceptually with these suggestions, and will discuss the issues with the North Carolina Department of Transportation.

The National Wildlife Federation also expressed concern over the use of language in the proposal that perpetuates the fallacy that wolves are a threat to human life, and recommended that the Service delete all references in the final regulation to "life threatening" conflicts.

Response: The Service certainly agrees that red wolves released into the refuge for the reintroduction attempt will in reality never prove a threat to any humans in the area. In fact, as the results of the 1978 experiment in South Carolina showed, it is very likely that humans will rarely, if ever, even *see* red wolves in the vast and impenetrable habitat of the refuge. However, as noted previously, under some circumstances it [illegible] difficult or impossible to [illegible] lf from a more [illegible] dog. The Service [illegible] rson in such [illegible] ces will use all reasonable means to avoid a response not proportionate to the perceived threat, but in a potentially life-threatening situation the Service does not expect a person to hesitate in self-defense or defending others while attempting to make an identification of the animal. A related consideration for the Service in developing the special rule has been the need to foster public acceptance of the red wolf population. The knowledge people have about the degree of threat posed by a red wolf still varies widely. At the end of the 5-year experimental phase of the project, the Service will be most interested in assessing changes in public attitude regarding wolves. During the interim, the Service is of the opinion that the language as expressed in the proposed rule should be retained.

National Environmental Policy Act

An environmental assessment under NEPA has been prepared and is available to the public at the Service's Asheville Field Office (see **ADDRESSES** section), Atlanta Regional Office (see **FOR FURTHER INFORMATION CONTACT** section), or the Office of Endangered Species, 1000 N. Glebe Road, Arlington, Virginia 22201 (202/235–2760). It has been determined that this action is not a major Federal action which would significantly affect the quality of the human environment within the meaning of section 102(2)(C) of the National Environmental Policy Act of 1969 (implemented at 40 CFR Parts 1500 through 1508).

Executive Order 12291, Paperwork Reduction Act, and Regulatory Flexibility Act

The U.S. Fish and Wildlife Service has determined that this is not a major rule as defined by Executive Order 12291; that the rule would not have a significant economic effect on a substantial number of small entities as described in the Regulatory Flexibility Act (Pub. L. 96–354). The introduction site occurs within 15 miles of Atlantic Ocean resorts in a region along the Outer Banks that can be considered a high use area for vacations and wildlife enthusiasts. However, the mainland portion of Dare County is not in the vicinity of a high concentration of year-round inhabitants. The refuge has been set aside by the Federal government for wildlife use. The introduction of a nonessential experimental population into this refuge and the use by these animals of adjacent Federal lands is compatible with current utilization of the refuge and adjacent Federal lands and is expected to have no adverse impact on public use days. It is reasonable to expect some increase in visitor use of the refuge after the release of the red wolves. No private entities will be affected by this action. The rule as presented does not contain any information collection or record keeping requirements as defined in the Paperwork Reduction Act of 1980 (Pub. L. 96–511).

Authors

The principal authors of this rule are Warren T. Parker, Endangered Species Field Office, Asheville, North Carolina (704/259–0321), Marshall P. Jones, Atlanta Regional Office, Atlanta, Georgia (404/331–3583), and Peter G. Poulos, Office of Endangered Species, Washington, DC (202/235–2760).

List of Subjects in 50 CFR Part 17

Endangered and threatened wildlife, Fish, Marine mammals, Plants (agriculture).

Regulation Promulgation

PART 17—[AMENDED]

Accordingly, Part 17, Subchapter B of Chapter I, Title 50 of the U.S. Code of Federal Regulations, is hereby amended as set forth below:

1. The authority citation for Part 17 continues to read as follows:

Authority: Pub. L. 93–205, 87 Stat. 884; Pub. L. 94–359, 90 Stat. 911; Pub. L. 95–632, 92 Stat. 3751; Pub. L. 96–159, 93 Stat. 1225; and Pub. L. 97–304, 96 Stat. 1411 (16 U.S.C. 1531 *et seq.*).

2. Section 17.11(h) is amended by revising the entry for this "red wolf" species to read as shown below:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Scientific name	Common name						
MAMMALS							
*	*	*	*	*	*	*	
Red wolf	*Canis rufus*	U.S.A. (SE U.S.A., west to central TX).	Entire except Dare, Tyrrell, Hyde, and Washington Counties, NC.	E	1	NA	NA
Do	do	do	U.S.A. NC-Dare, Tyrrell, Hyde, Washington Cos.	XN	....	NA	17.84(c)
*	*	*	*	*	*	*	

3. Section 17.84 is amended by adding new paragraph (c) as follows:

§ 17.84 Special rules—vertebrates.

* * * * *

(c) Red wolf (*Canis rufus*). (1) The red wolf population identified in paragraph (c)(9) of this section is a nonessential experimental population.

(2) No person may take this species, except as provided in paragraphs (c)(3) through (5) and (10) of this section.

(3) Any person with a valid permit issued by the Service under § 17.32 may take red wolves for educational purposes, scientific purposes, the enhancement or propagation or survival of the species, zoological exhibition, and other conservation purposes consistent with the Act and in accordance with applicable State fish and wildlife conservation laws and regulations;

(4) Any person may take red wolves in defense of that person's own life or the lives of others, *Provided* that such taking shall be immediately reported to the refuge manager, as noted in paragraph (c)(6) of this section.

(5) Any employee or agent of the Service or State conservation agency who is designated for such purposes, when acting in the course of official duties, may take a red wolf if such action is necessary to:

(i) Aid a sick, injured, or orphaned specimen;

(ii) Dispose of a dead specimen, or salvage a dead specimen which may be useful for scientific study;

(iii) Take an animal which constitutes a demonstrable but nonimmediate threat to human safety, or which is responsible for depredations to lawfully present domestic animals or other personal property, if it has not been possible to otherwise eliminate such depredation or loss of personal property, *Provided* that such taking must be done in a humane manner, and may involve killing or injuring the animal only if it has not been possible to eliminate such threat by live capturing and releasing the specimen unharmed on the refuge.

(6) Any taking pursuant to paragraphs (c)(3) through (5) must be immediately reported to the Refuge Manager, Alligator River National Wildlife Refuge, Manteo, North Carolina, telephone 919/473–1131, who will determine disposition of any live or dead specimens.

(7) No person shall possess, sell, deliver, carry, transport, ship, import, or export by any means whatsoever, any such species taken in violation of these regulations or in violation of applicable State fish and wildlife laws or regulations or the Endangered Species Act.

(8) It is unlawful for any person to attempt to commit, solicit another to commit, or cause to be committed, any offense defined in paragraphs (c) (2) through (7) of this section.

(9) The site for reintroduction of red wolves is within the historic range of the species in the State of North Carolina, on the Alligator River National Wildlife Refuge, Dare County; the adjacent Tyrrell, Hyde, and Washington Counties are also included in the experimental population designation. The red wolf is otherwise extirpated from the wild, so there are no other extant populations with which this experimental population could come into contact.

(10) The reintroduced population will be continually monitored closely during the life of the project, including the use of radio telemetry as appropriate. All animals will be vaccinated against diseases prevalent in canids prior to release. Any animal which is sick, injured, or otherwise in need of special care, or which moves off Federal lands, will be immediately recaptured by the Service and given appropriate care. Such an animal will be released back to the wild on the refuge as soon as possible, unless physical or behavioral problems make it necessary to return the animal to a captive breeding facility.

(11) The status of the population will be reevaluated within 5 years of the effective date of this regulation to determine future management status and needs. This review will take into account the reproductive success of the mated pairs, movement patterns of individual animals, food habits, and the overall health of the population.

Dated: October 24, 1986.

Susan Recce,

Deputy Assistant Secretary for Fish and Wildlife and Parks.

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BILLING CODE 4310-55-M

(d) The Fish and Wildlife Service shall consult with appropriate State fish and wildlife agencies, local governmental entities, affected Federal agencies, and affected private landowners in developing and implementing experimental population rules. When appropriate, a public meeting will be conducted with interested members of the public. Any regulation promulgated pursuant to this section shall, to the maximum extent practicable, represent an agreement between the Fish and Wildlife Service, the affected State and Federal agencies and persons holding any interest in land which may be affected by the establishment of an experimental population.

(e) Any population of an endangered species or a threatened species determined by the Secretary to be an experimental population in accordance with this subpart shall be identified by special rule in §§17.84–17.86 as appropriate and separately listed in §17.11(h) (wildlife) or §17.12(h) (plants) as appropriate.

(f) The Secretary may designate critical habitat as defined in section (3)(5)(A) of the Act for an essential experimental population as determined pursuant to paragraph (c)(2) of this section. Any designation of critical habitat for an essential experimental population will be made in accordance with section 4 of the Act. No designation of critical habitat will be made for nonessential populations. In those situations where a portion or all of an essential experimental population overlaps with a natural population of the species during certain periods of the year, no critical habitat shall be designated for the area of overlap unless implemented as a revision to critical habitat of the natural population for reasons unrelated to the overlap itself.

§ 17.82 Prohibitions.

Any population determined by the Secretary to be an experimental population shall be treated as if it were listed as a threatened species for purposes of establishing protective regulations under section 4(d) of the Act with respect to such population. The Special rules (protective regulations) adopted for an experimental population under §17.81 will contain applicable prohibitions, as appropriate, and exceptions for that population.

§ 17.83 Interagency cooperation.

(a) Any experimental population designated for a listed species (1) determined pursuant to §17.81(c)(2) of this subpart not to be essential to the survival of that species and (2) not occurring within the National Park System or the National Wildlife Refuge System, shall be treated for purposes of section 7 (other than subsection (a)(1) thereof) as a species proposed to be listed under the Act as a threatened species.

(b) Any experimental population designated for a listed species that either (1) has been determined pursuant to §17.81(c)(2) of this subpart to be essential to the survival of that species, of (2) occurs within the National Park System or the National Wildlife Refuge System as now or hereafter constituted, shall be treated for purposes of section 7 of the Act as a threatened species. Notwithstanding the foregoing, any biological opinion prepared pursuant to section 7(b) of the Act and any agency determination made pursuant to section 7(a) of the Act shall consider any experimental and nonexperimental populations to constitute a single listed species for the purposes of conducting the analyses under such sections.

§ 17.84 Special rules—vertebrates.

(a) [Reserved]

(b) Colorado squawfish (*Ptychocheilus lucius*) and woundfin (*Plagopterus* argentissimus). (1) The Colorado squawfish and woundfin populations identified in paragraph (b)(6) of this section, are experimental, nonessential populations.

(2) No person shall take the species, except in accordance with applicable State or Tribal fish and wildlife conservation laws and regulations in the following instances:

(i) For educational purposes, scientific purposes, the enhancement of propagation or survival of the species, zoological exhibition, and other conservation purposes consistent with the Act; or

(ii) Incidental to otherwise lawful activities, provided that the individual

fish taken, if still alive, is immediately returned to its habitat.

(3) Any violation of applicable State or Tribal fish and wildlife conservation laws or regulations with respect to the taking of this species (other than incidental taking as described in paragraph (b)(2)(ii) of this section) will also be a violation of the Endangered Species Act.

(4) No person shall possess, sell, deliver, carry, transport, ship, import, or export, by any means whatsoever, any such species taken in violation of these regulations or in violation of applicable State or Tribal fish and wildlife laws or regulations.

(5) It is unlawful for any person to attempt to commit, solicit another to commit, or cause to be committed, any offense defined in paragraphs (b) (2) through (4) of this section.

(6) All of the sites for reintroduction of Colorado squawfish and woundfin are totally isolated from existing populations of these species. The nearest population of Colorado squawfish is above Lake Powell in the Green and Colorado Rivers, an upstream distance of at least 800 miles including 6 mainstream dams, and 200 miles of dry riverbed. Woundfin are similarly isolated (450 miles distant, 200 miles of dry streambed and 5 mainstream dams). All reintroduction sites are within the probable historic range of these species and are as follows:

Colorado Squawfish

(i) *Arizona: Gila County*. Salt River from Roosevelt Dam upstream to U.S Highway 60 bridge.

(ii) *Arizona: Gila and Yavapai Counties*. Verde River from Horseshoe Dam upstream to Perkinsville.

The lower segments of large streams which flow into these two sections of river may, from time to time, be inhabited by Colorado squawfish. Downstream movement of squawfish in these areas will be restricted by dams and upstream movement is limited by lack of suitable habitat.

Woundfin

(i) *Arizona: Gila and Yavapai Counties*. Verde River from backwaters of Horseshoe Reservoir upstream to Perkinsville.

(ii) *Arizona: Graham and Greenlee Counties*. Gila River from backwaters of San Carlos Reservoir upstream to Arizona/New Mexico State line.

(iii) *Arizona: Greenlee County*. San Francisco River from its junction with the Gila River upstream to the Arizona/New Mexico State line.

(iv) *Arizona: Gila County*. Tonto Creek, from Punkin Center upstream to Gisela.

(v) *Arizona: Yavapai County*. Hassayampa River, from Red Cliff upstream to Wagoner.

The movement of woundfin beyond these areas will be limited to the lower portion of larger tributaries where suitable habitat exists. Downstream movement is limited by dams, reservoirs, and dry streambed. Upstream movement from these areas is restricted due to the absence of habitat. Upstream areas are too cold and the gradient is too steep to support populations of woundfin.

(7) The reintroduced populations will be checked annually to determine their condition. A seining survey will be used to determine population expansion or contraction, reproduction success, and general health condition of the fish.

(c) Red wolf (*Canis rufus*). (1) The red wolf populations identified in paragraphs (c)(9)(i) and (c)(9)(ii) of this section are nonessential experimental populations.

(2) No person may take this species, except as provided in paragraphs (c)(3) through (5) and (10) of this section.

(3) Any person with a valid permit issued by the Service under §17.32 may take red wolves for educational purposes, scientific purposes, the enhancement of propagation or survival of the species, zoological exhibition, and other conservation purposes consistent with the Act and in accordance with applicable State fish and wildlife conservation laws and regulations;

(4)(i) Any person may take red wolves found on private land in the areas defined in paragraphs (c)(9) (i) and (ii) of this section, *Provided* that such taking is not intentional or willful, or is in defense of that person's own life or the lives of others; and that such taking is reported within 24 hours to the refuge manager (for the red wolf population defined in paragraph (c)(9)(i) of this section), the Park superintendent (for the red wolf population defined in paragraph (c)(9)(ii) of this section), or the State wildlife enforcement officer for investigation.

(ii) Any person may take red wolves found on lands owned or managed by Federal, State, or local government

agencies in the areas defined in paragraphs (c)(9) (i) and (ii) of this section, *Provided* that such taking is incidental to lawful activities, is unavoidable, unintentional, and not exhibiting a lack of reasonable due care, or is in defense of that person's own life or the lives of others, and that such taking is reported within 24 hours to the refuge manager (for the red wolf population defined in paragraph (c)(9)(i) of this section), the Park superintendent (for the red wolf population defined in paragraph (c)(9)(ii) of this section), or the State wildlife enforcement officer for investigation.

(iii) Any private landowner, or any other individual having his or her permission, may take red wolves found on his or her property in the areas defined in paragraphs (c)(9) (i) and (ii) of this section when the wolves are in the act of killing livestock or pets, *Provided* that freshly wounded or killed livestock or pets are evident and that all such taking shall be reported within 24 hours to the refuge manager (for the red wolf population defined in paragraph (c)(9)(i) of this section), the Park superintendent (for the red wolf population defined in paragraph (c)(9)(ii) of this section), or the State wildlife enforcement officer for investigation.

(iv) Any private landowner, or any other individual having his or her permission, may harass red wolves found on his or her property in the areas defined in paragraphs (c)(9) (i) and (ii) of this section, *Provided* that all such harassment is by methods that are not lethal or physically injurious to the red wolf and is reported within 24 hours to the refuge manager (for the red wolf population defined in paragraph (c)(9)(i) of this section), the Park superintendent (for the red wolf population defined in paragraph (c)(9)(ii) of this section), or the State wildlife enforcement officer, as noted in paragraph (c)(6) of this section for investigation.

(v) Any private landowner may take red wolves found on his or her property in the areas defined in paragraphs (c)(9) (i) and (ii) of this section after efforts by project personnel to capture such animals have been abandoned, *Provided* that the Service project leader or biologist has approved such actions in writing and all such taking shall be reported within 24 hours to the Service project leader or biologist, the refuge manager (for the red wolf population defined in paragraph (c)(9)(i) of this section), the Park superintendent (for the red wolf population defined in paragraph (c)(9)(ii) of this section), or the State wildlife enforcement officer for investigation.

(vi) The provisions of paragraphs (4) (i) through (v) of this section apply to red wolves found in areas outside the areas defined in paragraphs (c)(9) (i) and (ii) of this section, with the exception that reporting of taking or harassment to the refuge manager, Park superintendent, or State wildlife enforcement officer, while encouraged, is not required.

(5) Any employee or agent of the Service or State conservation agency who is designated for such purposes, when acting in the course of official duties, may take a red wolf if such action is necessary to:

(i) Aid a sick, injured, or orphaned specimen;

(ii) Dispose of a dead specimen, or salvage a dead specimen which may be useful for scientific study;

(iii) Take an animal that constitutes a demonstrable but non-immediate threat to human safety or that is responsible for depredations to lawfully present domestic animals or other personal property, if it has not been possible to otherwise eliminate such depredation or loss of personal property, *Provided* That such taking must be done in a humane manner, and may involve killing or injuring the animal only if it has not been possible to eliminate such threat by live capturing and releasing the specimen unharmed on the refuge or Park;

(iv) Move an animal for genetic purposes.

(6) Any taking pursuant to paragraphs (c) (3) through (5) of this section must be immediately reported to either the Refuge Manager, Alligator River National Wildlife Refuge, Manteo, North Carolina, telephone 919/473–1131, or the Superintendent, Great Smoky Mountains National Park, Gatlinburg, Tennessee, telephone 615/436–

1294. Either of these persons will determine disposition of any live or dead specimens.

(7) No person shall possess, sell, deliver, carry, transport, ship, import, or export by any means whatsoever, any such species taken in violation of these regulations or in violation of applicable State fish and wildlife laws or regulations or the Endangered Species Act.

(8) It is unlawful for any person to attempt to commit, solicit another to commit, or cause to be committed, any offense defined in paragraphs (c) (2) through (7) of this section.

(9)(i) The Alligator River reintroduction site is within the historic range of the species in North Carolina, in Dare, Hyde, Tyrrell, and Washington Counties; because of its proximity and potential conservation value, Beaufort County is also included in the experimental population designation.

(ii) The red wolf also historically occurred on lands that now comprise the Great Smoky Mountains National Park. The Park encompasses properties within Haywood and Swain Counties in North Carolina, and Blount, Cocke, and Sevier Counties in Tennessee. Graham, Jackson, and Madison Counties in North Carolina, and Monroe County in Tennessee, are also included in the experimental designation because of the close proximity of these counties to the Park boundary.

(iii) Except for the three island propagation projects and these small reintroduced populations, the red wolf is extirpated from the wild. Therefore, there are no other extant populations with which the refuge or Park experimental populations could come into contact.

(10) The reintroduced populations will be monitored closely for the duration of the project, generally using radio telemetry as appropriate. All animals released or captured will be vaccinated against diseases prevalent in canids prior to release. Any animal that is determined to be in need of special care or that moves onto lands where the landowner requests their removal will be recaptured, if possible, by Service and/or Park Service and/or designated State wildlife agency personnel and will be given appropriate care. Such animals will be released back into the wild as soon as possible, unless physical or behavioral problems make it necessary to return the animals to a captive-breeding facility.

(11) The status of the Alligator River National Wildlife Refuge project will be reevaluated by October 1, 1992, to determine future management status and needs. This review will take into account the reproductive success of the mated pairs, movement patterns of individual animals, food habits, and overall health of the population. The duration of the first phase of the Park project is estimated to be 10 to 12 months. After that period, an assessment of the reintroduction potential of the Park for red wolves will be made. If a second phase of reintroduction is attempted, the duration of that phase will be better defined during the assessment. However, it is presently thought that a second phase would last for 3 years, after which time the red wolf would be treated as a resident species within the Park. Throughout these periods, the experimental and nonessential designation of the animals will remain in effect.

(d) Topeka shiner (*Notropis topeka*).

(1) *Where is the Topeka shiner designated as a nonessential experimental population (NEP)?* (i) The NEP area for the Topeka shiner is within the species' historical range and includes those waters within the Missouri counties of Adair, Gentry, Harrison, Putnam, Sullivan, and Worth identified below in paragraph (d)(5) of this section.

(ii) The Topeka shiner is not known to currently exist in Adair, Gentry, Putnam, Sullivan, and Worth Counties in Missouri, or in those portions of Harrison County, Missouri, where the NEP is being designated. Based on its habitat requirements and potential predation by other fish predators, we do not expect this species to become established outside this NEP area, although there is a remote chance it may.

(iii) We will not change the NEP designations to ''essential experimental,'' ''threatened,'' or ''endangered'' within the NEP area without a public rulemaking. Additionally, we will not designate critical habitat for this NEP, as provided by 16 U.S.C. 1539(j)(2)(C)(ii).

Frequently Asked Questions: Red Wolf Recovery Program Review

Why did the U.S. Fish and Wildlife Service (Service) conduct a review for the Red Wolf Recovery Program?
The Service recognized a need to gather additional science and research to better guide recovery of the endangered red wolf under the Endangered Species Act (ESA). To that end, the Service initiated a two-year, two-step review of the red wolf recovery program including the non-essential, experimental population in northeastern North Carolina. The review began in 2014 with a peer-reviewed program assessment by the Wildlife Management Institute. It was later expanded in June 2015 to include recovery efforts beyond the program's wild population in North Carolina to help the Service identify actions necessary to guide red wolf recovery on the landscape. A recovery team was established last fall to examine feasibility of recovery, population viability, the historic range, and human dimensions. Its work led to a report with options for the Service to consider.

What issues did the Service consider in the review of the Red Wolf Recovery Program?
The Service worked closely with the North Carolina Wildlife Resources Commission, academia, non-governmental organizations, and private landowners to gather the best available science and review implementation of recovery actions associated with four components:

1) appropriate taxonomic designation and historic distribution of the red wolf;
2) long-term viability of the captive red wolf population;
3) recovery needs of the red wolf population given pressures such as hybridization with coyotes, human caused mortality, and climate change; and
4) how people and red wolves can co-exist.

What were the findings of the Service's review?
The science now available to the Service shows the ***captive population is not secure***. With no changes to current management, the species will likely be lost within the next decade. Under current conditions with only 29 breeding pairs in captivity, the population is unable to sustain itself. To secure the captive population, the Service and its partners must essentially double it to at least 400 wolves. Currently, there are slightly more than 200 red wolves in captivity. The number of breeding pairs must increase to a minimum of 52.

Relative to the ***red wolf's genetics***, there is disagreement in the scientific community regarding the taxonomy and genetic ancestry of the red wolf. The Service is moving forward with the belief that the red wolf remains a listable entity.

The Wildlife Management Institute (WMI) examined the red wolf's ***historic range*** as part of the Service's review. WMI concluded that an accurate predictor of the red wolf's range includes all or parts of a significant part of the Southeast United States including North Carolina. The recovery team generally agrees with WMI's results.

The red wolf is a conservation-reliant species that requires intensive, hands-on management to sustain it in the wild. ***Hybridization*** with coyotes is an ongoing challenge exacerbated by human-caused mortality particularly when a pack loses breeding adults close to mating season. At this time, the reality is that it may simply not be possible to achieve competitive exclusion of coyotes and hybrids with red wolves in northeastern North Carolina. Therefore, the Service will be focusing its management efforts in Dare County and the federal lands there.

What is the decision on future of red wolf recovery?
Based on the best and latest scientific information gathered over the past 15 months, the Service has determined that recovery of the red wolf is feasible with significant changes that must be implemented to secure the captive and wild populations. Since the captive population is not secure, the Service will shift the Red Wolf Recovery Program's focus and resources toward securing the species by fully supporting the captive population. The numbers and type of red wolves managed by SSP partner institutions will need to be increased to a minimum of 400 animals with 52 breeding pairs. Red wolf recovery efforts will be refocused onto federal lands in Dare County, North Carolina. Additionally, the Service will manage the species as a single entity, encompassing both the captive population managed under the Species Survival Plan (SSP) and the non-essential, experimental wild population in northeastern North Carolina. .

How will this decision be implemented?
The Service will implement a series of actions to secure the captive and wild red wolf populations including:

- First, the Service will move quickly to secure the captive population of red wolves, which we now know is not sustainable in its current configuration.
- Second, the Service will determine where potential new sites exist for additional experimental wild populations by October 2017. The Service will ensure these determinations will comply with all environmental rules and include public engagement.
- Third, the Service will propose to revise the existing experimental population rule to apply only to the Dare County Bombing Range and Alligator River National Wildlife Refuge, where stable packs exist on federal lands. This proposed action will change the scope of and goals for the experimental population and is expected to be completed by December 2017. These proposed changes will go through appropriate environmental review and public comment.
- Finally, by October 2017 the Service working with others will complete a comprehensive Species Status Assessment and five-year status review for the red wolf, building on the foundation of work accomplished over the past two years and past history. This will guide the Service's recovery planning in the future.

What does the decision mean for the captive red wolf population?
As part of the Service's review of the Red Wolf Recovery Program, a population viability analysis was conducted to project the long-term demographic and genetic future of the captive red wolf population, which has been managed in zoos and partner facilities across the United States since 1969. This analysis shows that the captive population will likely be lost in the near future without careful management. While the captive population has been maintained at a relatively large population size of more than 150 animals for over 20 years, it needs to increase breeding and its population size to ensure the long-term viability and its ability to serve as a strong source for animals to release to the wild.

A robust captive population is needed to secure the species' survival and support the establishment of new reintroduction projects in the future. It is clear that more animals are needed in captivity to support any wild populatio including the current non-essential, experimental population in North Carolina. The captive population has the potential to be demographically strong, but additional space and improved breeding rates are needed to improve its outcomes in support of the entire red wolf recovery program. To secure the captive population, the numbers and type of red wolves managed by SSP partner institutions will need to be increased to a minimum of 400 animals with 52 breeding pairs. Currently, there are slightly more than 200 red wolves with 29 breeding pairs in captivity. To manage declining gene diversity that is likely under the status quo, the Service will now manage all red wolves—those in captivity and those in the wild—a single metapopulation with occasional movement of animals between SSP partner institutions and the non-essential, experimental population in northeastern North Carolina.

Why has the Service decided not to terminate the non-essential, experimental population in northeastern North Carolina?

The ultimate goal is to recover the red wolf in the wild. As such, the wild population in North Carolina is important to fostering the overall recovery of the species. Wild-born red wolves are biologically beneficial. While captive-born animals can be used at reintroduction sites, the Service's experience in North Carolina has revealed that restoration is much more difficult, time-consuming, and expensive using captive animals. Wild-born wolves have a greater chance of surviving in the wild. These animals are not habituated to human presence and care. They have the best chance of surviving the initial release, successfully establishing territories and reproducing.

Maintaining a smaller, more manageable wild population that is fully integrated with the captive population would:

- Allow for animals removed from the wild to support the necessary expansion and improved genetic health of the captive population;
- Retain some of the influences of natural selection on the gene pool;
- Service as a small stock source for new reintroduction efforts across the red wolf's historic range; and
- Provide a population of continued research on the species' wild behavior.

What are the Service's future plans for managing the non-essential, experimental red wolf population in northeastern North Carolina?

The Service will continue to manage the red wolf non-essential, experimental population in accordance with the 1995 rule (50 C.F.R. § 17.84(c)). However, the Service will propose to refocus of the project to federal lands within Dare County. Focusing efforts to federal lands is necessary to re-establish management control over the wild population by removing isolated wolf packs from lands that the Service lacks access, incorporating these animals into the captive population, and managing the remaining animals in accessible areas to minimize and manage risks of hybridization. This would result in a smaller non-essential, experimental project in terms of population size, the number of packs/breeding pairs, and the area occupied.

The transition from a five-county recovery area to just one county would start with the continued effort to remove wolves from private lands where they are not welcome. Red wolves removed from private lands outside of Dare County would be relocated to SSP partner institutions.

Moving forward, the captive and wild populations no longer be managed separately. The Service will manage all red wolves as one single metapopulation. Animals will be moved between the captive and wild populations to grow the captive population and maintain genetic diversity for both populations.

Are you removing red wolves from the landscape?
Not completely. The Service proposes to refocus red wolf recovery efforts in North Carolina to those on federal lands in Dare County to re-establish management control over the wild population by removing isolated wolf packs from lands that the Service lacks access, incorporating these animals into the captive population, and managing the remaining animals in accessible areas to minimize and manage risks of hybridization. This would result in a smaller non-essential, experimental population, the number of packs/breeding pairs, and the area occupied within the current rules. As such, the Service would remove red wolves from private lands outside of Dare County. Wolves removed from private lands in North Carolina would be released on federal lands in Dare County or relocated to a SSP partner institution.

What are some of the actions the Service will take to manage the presence of red wolves on private lands under the proposed refocused management effort?
Red wolves are federally-listed under the ESA and, in the case of the non-essential experimental population, are protected on public and private lands under the Service's 1995 rule. Even with the refocused and more efficient management effort, the Service recognizes that red wolves will not stay on federal lands in Dare County. The Service proposes to limit non-essential, experimental population protections to Dare County. The Service will continue its efforts to remove red wolves from private lands when requested to do so by the landowner. Private landowners also will be allowed to take animals when authorized by a permit in accordance with the regulation. Red wolves removed from the landscape will be handled and cared for humanely. Some wolves removed from private lands would be released on to Alligator River National Wildlife Refuge and others will be relocated to a SSP institution to grow the captive population and maintain genetic diversity for the species. If a wolf has a health or behavioral problem, it will not be returned to the wild but would be placed in captivity or disposed of in accordance with our management protocols. The Service will continue to seek written agreements with willing landowners adjacent to federal lands to facilitate management of the remaining wild wolves.

Why is the non-essential, experimental population in North Carolina important to red wolf recovery?
The September 1987 release of red wolves into the Alligator River National Wildlife Refuge marked the first time in this Nation's history that a federally-listed species was reintroduced to the historic range from which it had been extirpated. Prior to this reintroduction, the remaining red wolf populations existed solely in captivity. Later, other wolf reintroductions, which were modeled on our program, such as that of the gray wolf into the Greater Yellowstone Ecosystem, have occurred as a means to recover wolf species in the wild. The Service has learned a great deal about the red wolf from the non-essential, experimental population, including, but not limited to, the species' dispersal patterns and need for large home ranges. We also have acquired knowledge about the extent to which coyotes threaten red wolves through gene introgression and the importance of maintaining intact red wolf breeding pairs to counter hybridization and coyote expansion. The Service has gained an increased appreciation of the value and necessity of working in partnership with the State of North Carolina and in engaging private landowners in our reintroduction effort.

The wild population in North Carolina is biologically important to the overall recovery of the red wolf and is integral to proposed path forward. Wild-born red wolves have the best chance of surviving and successfully establishing territories and reproducing. As such, the Service is proposing to manage a

smaller wild population in North Carolina. Maintaining a smaller, more manageable wild population that is fully integrated with the captive population would:

- Allow for animals removed from the wild to support the necessary expansion and improved genetic health of the captive population;
- Retain some of the influences of natural selection on the gene pool;
- Service as a small stock source for new reintroduction efforts across the red wolf's historic range; and
- Provide a population of continued research on the species' wild behavior.

Has the Service identified possible sites for future non-essential, experimental projects?
No. The Service must first secure the captive population before establishing any new populations in the wild.

Is the red wolf a distinct species?
There is disagreement within the scientific community regarding the taxonomy and genetic ancestry of the red wolf. As part of the review, the Service worked with the U.S. Geological Survey and the North Carolina State University to delve further into this issue. Disagreement remains, and we expect the scientific debate in this area to continue. The Service is moving forward with the belief that the red wolf remains a listable entity under the ESA. Currently, the Service recognizes the red wolf as a distinct species and has listed it as such.

What is the current size of the wild red wolf population for the non-essential, experimental project in North Carolina?
The current population estimate is 45 individuals that include 28 with radio collars and one with a satellite collar. Overall, this population consists of five packs and three known breeding pairs, widely distributed across Beaufort, Dare, Hyde, Tyrrell and Washington counties.

What canid species occur in the red wolf recovery area in northeastern North Carolina?
The canids that occur in the recovery area in North Carolina include red wolves, coyotes, and hybrids from interbreeding between red wolves and coyotes. The Service began managing red wolf hybridization with coyotes in 2000. Since then, the amount of coyote DNA in the non-essential, experimental red wolf population has decreased to less than four percent (Gese et al. 2015).

Were Section 7 consultations completed for all the releases of any wolves from captivity into the wild?
No. Consultation was only completed in 1986 for up to six mated pairs of red wolves to be released from captivity. The determination at that time was that the species' reproductive vigor in captivity was secured and its survival was biologically assured. However, all additional releases of captive animals were coordinated with the SSP partner institutions to ensure no negative impacts to the captive population. Releases on private lands occurred with at least verbal permission of the landowner.

Will the Service complete Section 7 consultations for the refocused management approach of the non-essential, experimental project in North Carolina?
Yes. The Service will complete Section 7 consultations on the recovery actions implemented as part of the proposed refocused effort.

What is a recovery team?
Section 4(f) of the ESA allows for the Service to establish a recovery team of appropriate public and private agencies, organizations and individuals to assist in the development and implementation of recovery plans for federally protected species. These teams serve at the request of the Service's Regional Director.

Why did the Service convene a new red wolf recovery team?
The Service took steps to involve state partners and key stakeholders in the review of the Red Wolf Recovery Program. A multi-faceted recovery team was reconvened in October 2015 to address current and future needs to restore red wolves in the wild. The team—comprised of representatives from federal and state agencies, university scientists, species experts, representatives from non-governmental organizations, county officials, and private landowners—reviewed the implementation of recovery actions and the science of red wolf conservation related to species taxonomy and historic range, population viability, and human dimensions.

How did the Service select the red wolf recovery team members?
The red wolf recovery team members were selected based on professional scientific expertise or experience in one or more of the four components of the review, as well as their capacity to help with the next steps in recovery planning and implementation. The diverse composition of the recovery team reflected the Service's commitment to ensure its actions are first, and foremost, grounded in sound science while also addressing any identified shortcomings of our past recovery efforts, especially in terms of engaging landowners in recovery planning and program implementation.

Is it typical to have non-biologists on a recovery team?
Yes. Recovery teams are often used to bring together the diversity of expertise necessary to develop an effective recovery program for a federally protected species and help with its implementation. This concept proved very valuable for the manatee recovery efforts. Recover teams provide numerous advantages including: focusing best available science, increasing depth of expertise, and providing a mechanism for multiple agencies and engaged stakeholders to interact and participate in the planning and implementation of actions necessary to recover and sustain the listed species.

What were the findings of the recovery team?
The recovery team met in-person on two occasions beginning in December 2015 and conducted most of the evaluation through a series of five teleconferences facilitated by a neutral third party. The team defined potential options for the future direction of red wolf conservation, ranging from options that would discontinue all red wolf conservation actions in the wild to options that would move toward what the recovery team considered full recovery of the species in the wild. The Recovery Team identified points of consensus as they emerged, such as the need for sustaining and expanding the captive population to ensure long-term preservation of the red wolf genome. Additionally, there were many points of disagreement and dissenting views, such as whether or not recovery of the red wolf in the wild is feasible. These areas of agreement and disagreement are noted throughout the recovery team's report, available here.

Has the Service responded to a request from the North Carolina Wildlife Resources Commission to declare the red wolf extinct in the wild and end the reintroduction program in North Carolina?
During a January 29, 2015, meeting, the North Carolina Wildlife Resource Commission (NCWRC) adopted a resolution requesting the Service declare the red wolf extinct in the wild and to terminate the reintroduction program in North Carolina. The Service has not formally responded to the

resolution. However, the Service has informally discussed the resolution and NCWRC's position on the red wolf recovery program in North Carolina through its strong relationship with the Commissioners and NCWRC Executive Director Gordon Myers. Since the resolution was adopted, Service regional leaders have met multiple times with the Commissioners to discuss the red wolf recovery program and other management issues in eastern North Carolina. Additionally, Southeast Regional Director Cindy Dohner has attended NCWRC meetings to provide updates on the review wolf review and is in regular contact with Executive Director Myers on this matter.

The Service has addressed concerns included in the resolution as part its review of the Red Wolf Recovery Program. The best available information shows that termination of the non-essential, experimental population in northeastern North Carolina and status quo recovery efforts are two management options not appropriate at this time considering the Service's obligations under the ESA.

Documents supporting the Service's review of the Red Wolf Recovery Program and other information related to the red wolf, is available at www.fws.gov/redwolf/evaluation/.

Red Wolf Recovery Program

Photo credit: Amy Johnson

3rd Quarter Report

April - June 2011

Coordinator: David R. Rabon Jr., PhD
Wildlife Biologists: Art Beyer, Chris Lucash, Ford Mauney, Michael L. Morse
Biological Technician: Ryan Nordsven
Public Affairs and Outreach Coordinator: Vacant
Administrative Assistant: Vacant
Intern(s): Jessica Collins/D.J. Sharp

www.fws.gov/redwolf

trackthepack.blogspot.com

www.facebook.com/redwolfrecoveryprogram

The Red Wolf Recovery Program

The red wolf (*Canis rufus*) is one of the most endangered canids in the world. Once occurring throughout the eastern and south-central United States, red wolves were decimated by predator-control programs and the loss and alteration of habitats. By the 1970s, these activities had reduced the red wolf population to a small area along the Gulf coast of Texas and Louisiana. To protect the species from extinction, the U.S. Fish and Wildlife Service initiated efforts to locate and capture as many red wolves as possible for the purposes of establishing a program to breed the species in captivity and one day reintroduce the species into a portion of its former range. More than 400 canids were captured in coastal areas of Texas and Louisiana, but only 17 were identified as pure red wolves. Fourteen of these wolves would become the founding members of the captive-breeding program and the ancestors of all red wolves existing today.

The first litter of red wolves born in captivity occurred in 1977. Within a few years red wolves were successfully reproducing in captivity, allowing the U.S. Fish and Wildlife Service to consider reintroducing the species in the wild. In 1987, four male-female pairs of red wolves were released in Alligator River National Wildlife Refuge (ARNWR) in northeastern North Carolina and designated as an experimental population. Since then, the experimental population has grown and the recovery area expanded to include four national wildlife refuges, a Department of Defense bombing range, state-owned lands, and private lands, encompassing about 1.7 million acres. However, interbreeding with the coyote (a species not native to North Carolina) has been recognized as a threat affecting the restoration of red wolves. Currently, adaptive management efforts are making progress in reducing the threat of coyotes to the red wolf population in northeastern North Carolina. Other threats, such as habitat fragmentation, disease, and anthropogenic mortality, are of concern in the restoration of red wolves. Efforts to reduce the threats are presently being explored.

Program Objectives

The current recovery plan (U.S. Fish and Wildlife Service, 1990) specifies the following objectives:

1) Establish and maintain at least three red wolf populations via restoration projects within the historic range of the red wolf. Each population should be numerically large enough to have the potential for allowing natural evolutionary processes to work within the species. This must be paralleled by the cooperation and assistance of at least 30 captive-breeding facilities in the United States.
2) Preserve 80% to 90% of red wolf genetic diversity for 150 years.
3) Remove threats of extinction by achieving a wild population of approximately 220 wolves and a captive population of approximately 330 wolves.
4) Maintain the red wolf into perpetuity through embryo banking and cryogenic preservation of sperm.

The Red Wolf Population

We estimate between 110 and 130 red wolves in the Red Wolf Recovery Area, but for the purposes of this report all population figures are comprised only of known wolves (i.e., wolves that are regularly monitored through either a functioning radio-collar or surgically implanted abdominal radio transmitter). Additional wolves are likely present, but have not been captured/radio-collared or their continued presence otherwise confirmed.

Population and Territory Status

A total of 82 known red wolves occupied the Red Wolf Recovery Area (i.e., 1.7 million acres in five counties in northeastern North Carolina) at the end of the third quarter of our fiscal year 2011 (FY 11). The population includes 30 packs (totaling 64 wolves) with 11 breeding pairs. An additional 18 wolves are not known to be associated with a pack. [A pack is defined as a known wolf maintaining an established territory who is either currently associating with or is known to have associated with another wild canid inhabiting the same territory.]

The Red Wolf Recovery Program documented 11 litters (totaling 46 pups) born in the Red Wolf Recovery Area during the 2011 whelping season. Additional pups and/or litters could be present, but have not been confirmed. Two pups born in captivity at Miller Park Zoo (Bloomington, IL) were fostered into a wild litter. Pups born during the 2011 whelping season are not included in the reported population numbers.

Wolf Pairings

Two breeding pairs were lost during the quarter due to the deaths of the breeding male from one pack and the breeding female from another pack.

Wolf Captures and Radio Telemetry Marking

During this quarter, Red Wolf Recovery Program staff logged approximately 1,100 trap-nights. For that effort, 3 wolves were captured, none of which were first time captures. All wolves were fitted or re-fitted with radio-collars (VHF or GPS) and released. Captured wolves consisted of one adult (> 2 years of age) male and two adult females.

Dispersals

There were no known dispersals during the quarter.

Mortalities

Six known wolves (4 males, 2 females; 5 adults, 1 juvenile) from the Red Wolf Recovery Area are known to have died during the quarter. Three of the deaths were due to apparent vehicle collision and one wolf died from a fatal heartworm infection. The cause of death could not be determined for two wolves.

Disappearances

The Red Wolf Recovery Program lost radio contact with one wolf (a juvenile male) during the quarter.

Pack Summaries

The Pack Summaries *section has been indefinitely discontinued due to recent events and current circumstances involving the apparent illegal take of red wolves within the Red Wolf Recovery Area.*

Collaborations

Research

The Red Wolf Recovery Program provided financial and in-kind support for collaborative research with scientists at other institutions, including universities, interagency divisions, and non-government research organizations. These investigations required project staff to assist outside researchers and graduate students in their efforts to better understand red wolf ecology, ecosystem function, and conservation efforts.

Project Title: Inbreeding avoidance in red wolves.
Graduate Student: Kristin Brzeski (PhD student)
Committee Chair/Principal Investigator: Sabrina Taylor, PhD, Louisiana State University

Project Title: Identifying management procedures to reduce red wolf-coyote interactions in eastern North Carolina.
Graduate Student: Joseph Hinton (PhD student)
Committee Chair/Principal Investigator: Michael Chamberlain, PhD, Louisiana State University

Project Title: Use of stable isotope analysis to elucidate predation patterns of sympatric canids.
Graduate Student: Anne-Marie Hodge (MS student)
Committee Chair/Principal Investigator: Brian Arbogast, PhD, University of North Carolina at Wilmington

Project Title: Assessment of spatial and temporal activities of red wolves using GPS and VHF telemetry data.
Graduate Student: Melissa Karlin (PhD student)
Committee Chair/Principal Investigator: John Chadwick, PhD, University of North Carolina at Charlotte

Project Title: Dietary overlap between red wolves (*Canis rufus*) and coyotes (*Canis latrans*) in Eastern North Carolina.
Graduate Student: Justin McVey (MS student)
Committee Chair/Principal Investigator: Chris Moorman, PhD, North Carolina State University

Project Title: Evaluating potential effects of widening US Highway 64 on red wolves, Washington, Tyrrell, and Dare Counties, North Carolina.
Graduate Student: Christine Proctor (PhD student)
Committee Chair/Principal Investigator: Michael R. Vaughan, PhD, Virginia Polytechnic Institute and State University (Virginia Tech)

Project Title: Sperm morphology and motility of the red wolf (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigators: Albrecht Schulte-Hostedde, PhD, Laurentian University, and Gabriela Mastromonaco, PhD, Toronto Zoo

Publications

The following publications have gone to print in this quarter. A complete list of publications related to red wolves can be found at http://www.fws.gov/redwolf/biblio.html.

Bohling, J.H., and L.P. Waits. 2011. Assessing the prevalence of hybridization between sympatric *Canis* species surrounding the red wolf (*Canis rufus*) recovery area in North Carolina. Molecular Ecology 20(10):2142-2156.

Sparkman, A.M., J. Adams, A. Beyer, T.D. Steury, L. Waits, and D.L. Murray. 2011. Helper effects on pup lifetime fitness in the cooperatively breeding red wolf (*Canis rufus*). Proceeding of the Royal Society Biological Sciences 278(1710): 1381-1389.

Sparkman, A.M., L.P. Waits, and D.L. Murray. 2011. Social and demographic effects of anthropogenic mortality: a test of the compensatory mortality hypothesis in the red wolf. PLoS One 6(6). [Available at: http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0020868].

Dissertations and Theses

Bohling, J.H. 2011. Exploring the patterns and mechanisms of red wolf (*Canis rufus*) hybridization in North Carolina. PhD dissertation. University of Idaho (Advisor: Lisette Waits, PhD).

Dellinger, J.A. 2011. Foraging and spatial ecology of red wolves (*Canis rufus*) in northeastern North Carolina. MS thesis. Auburn University (Advisor: Troy Best, PhD).

Presentations

Gunn, K., A.I. Schulte-Hostedde, G. Mastromonaco, K. Goodrowe, and W. Waddell. Effects of inbreeding on sperm morphology of the red wolf (*Canis rufus*). Canadian Society for Evolution and Ecology, May 12-15, 2011, Banff, Alberta, Canada. [Program and Abstract available on the internet at: http://www.ecoevo.ca/banff2011/en/].

Staff and Volunteers

The Red Wolf Recovery Program employs eight full-time staff, including the program coordinator, four wildlife biologists, a biological technician, a public affairs/outreach coordinator, and an administrative assistant. The public affairs/outreach coordinator and administrative assistant positions are currently vacant. The Red Wolf Recovery Program also benefits from an unpaid intern.

Outreach

Staff from the Red Wolf Recovery Program conduct presentations and attend events to inform and educate the public on the conservation needs of the red wolf and the restoration efforts of the Red Wolf Recovery Program. As part of our effort to assist educators, red wolf “discovery boxes” that include materials about the red wolf are distributed to educational facilities. The distribution of discovery boxes is managed by the Red Wolf Coalition. Requests for discovery boxes should be made to kwheeler@redwolves.com.

The Red Wolf Recovery Program also seeks to achieve a quality visitor and participant experience in the U.S. Fish and Wildlife Service’s priority recreational uses on National Wildlife Refuges. Our outreach efforts focus on four of the six program elements, including wildlife observation, wildlife photography, environmental education, and interpretation, and are conducted frequently in partnership with ARNWR and PLNWR educators and volunteers.

Presentations

Date	Location	Audience	Length	Attendance	Presenter
April 15	Dare Co.	Wildlands Network	2 hr	6	M. Morse
April 16	Dare Co.	Red Wolf Coalition	2 hr	5	A. Beyer
April 27	Dare Co.	ENC/SEVA Strategic Habitat Conservation Team	2 hr	40	D. Rabon
May 5	Hyde Co.	Mattamuskeet Elementary School	2 hr	44	C. Heffley
May 25	Dare Co.	Pains Bay Firefighters	30 min	8	R. Nordsven
June 1	Dare Co.	Pains Bay Firefighters	30 min	6	R. Nordsven
June 7	Dare Co.	Pains Bay Firefighters	30 min	8	R. Nordsven
June 13	Dare Co.	Pains Bay Firefighters	30 min	7	R. Nordsven
June 22	Dare Co.	Pains Bay Firefighters	30 min	6	R. Nordsven

Howlings

Date	Location	Event	Length	Attend	Presenter
April 23	Dare Co.	Earth Day Howling	2 hr	85	M. Morse K. Whidbee J. Collins C. Heffley
May 28	Dare Co.	Endangered Species Day Howling	2 hr	45	C. Heffley D.J. Sharp
June 1	Dare Co.	Summer Howling Safari	2 hr	8	C. Heffley M. Dreibelbis B. Garrett
June 8	Dare Co.	Summer Howling Safari	2 hr	36	C. Heffley M. Dreibelbis B. Garrett
June 15	Dare Co.	Summer Howling Safari	2 hr	36	M. Dreibelbis B. Garrett D.J. Sharp
June 22	Dare Co.	Summer Howling Safari	2 hr	59	B. Garrett D.J. Sharp
June 29	Dare Co.	Summer Howling Safari	2 hr	90	M. Dreibelbis D.J. Sharp

Website / Social Media

The Red Wolf Recovery Program recently launched Facebook and Flickr internet pages. Our Facebook page connects our program with "friends" from around the globe and informs them of the conservation efforts of the Red Wolf Recovery Program. The Facebook page can be found at www.facebook.com/redwolfrecoveryprogram. Our Flickr page provides a site for users to view and download high resolution pictures related to red wolves and the Red Wolf Recovery Program. Our Flickr page can be found at www.flickr.com/photos/trackthepack.

The Red Wolf Recovery Program also has a weblog that highlights the efforts of the Red Wolf Recovery Program staff in the conservation of the red wolf. The weblog combines text, images, videos, and links to other media related to its topic. The content includes educational, informational, and general journal entries written by program staff, and allows readers to leave comments in an interactive format. The weblog can be found at trackthepack.blogspot.com.

Media Inquires

The Red Wolf Recovery Program responded to numerous media inquiries during this quarter, including science writer DeLene Beeland (www.delene.us), who is writing a book about red wolves.

Partnerships

Species Survival Plan (SSP)

Species Survival Plan (SSP) captive facility coordination is based at Point Defiance Zoo & Aquarium (PDZA) in Tacoma, Washington. The SSP currently coordinates 40 captive red wolf sites at zoos and nature centers housing about 179 wolves. The following information is based on activities completed or conducted by the SSP Coordinator during the quarter reported. Additional information on the SSP can be found at www.fws.gov/redwolf or redwolfssp.org.

During the third week of April, the SSP Coordinator visited the Red Wolf Recovery Area to assist in the field program's annual search for wolf dens and wild red wolf pups. He posted a blog about his visit on the Red Wolf Recovery Program's blog site at http://trackthepack.blogspot.com/2011/05/where-theres-will-theres-way.html.

The SSP Coordinator reported numerous correspondence and communications regarding red wolves, including coordinating the transfer of wolves to accommodate SSP institutional requests; being interviewed by graduate student, Jeffrey Mittlestadt, from the University of North Carolina at Chapel Hill's School of Journalism for a video project on red wolf restoration (http://www.vimeo.com/22841350); coordinating the transfer of two captive-born pups from Miller Park Zoo (Bloomington, IL) to the Red Wolf Recovery Area for fostering into a wild litter; and, coordinating the potential transfer of red wolves in association with the Pains Bay Fire at Alligator River National Wildlife Refuge. Special thanks to Chris Lasher, of the North Carolina Zoological Park (Asheboro, NC), and Sherry Samuels, of the North Carolina Museum of Life and Science (Durham, NC), for offering accommodations to house additional wolves in response to the Pains Bay Fire.

Island Propagation Sites

The U.S. Fish and Wildlife Service utilizes island sites to propagate red wolves and contribute to the restoration of a wild red wolf population, primarily by inserting island-born wolves into the wild population as a means to augment the wild red wolf gene pool with "under-represented" genes from the captive population. Currently, the Red Wolf Recovery Program cooperates with St. Vincent National Wildlife Refuge in maintaining a breeding pair of red wolves on an island site.

Red Wolf Coalition

The Red Wolf Coalition (RWC) is a non-profit organization based in northeastern North Carolina that advocates for the long term survival of red wolf populations through education and outreach. The RWC's educational program teaches students about the history, biology, and status of the red wolf recovery program, and accompanies students to ARNWR and PLNWR to learn about the habitat of the red wolf. The RWC currently employees an Executive Director, and has a membership of approximately 400 individuals and organizations. Additional information on the RWC can be found at www.redwolves.com.

The Executive Director reported conducting seven red wolf education programs during the quarter. In-person presentations were given to 24 home-schooled children in Roanoke Rapids, NC; 39 5th and 6th graders from Raleigh, NC, at Pettigrew State Park (Creswell, NC); 11 adults and children at the RWC office in Columbia, NC; and, 50 adults and children in three different presentations at PLNWR. A video presentation was given at Exploris Middle School (Raleigh, NC) to 30 6th graders. The Executive Director also reported mailing educational "discovery boxes" containing a red wolf pelt and skull, a coyote pelt and skull, a radio telemetry collar, the Far Traveler teacher curriculum, a howling CD, red wolf tear sheets, the "Recovering a species" video, and RWC and FWS red wolf brochures to two elementary schools in NC.

The Executive Director reported that the RWC was awarded a grant from USDA Rural Development in the amount of $75,000 to construct a red wolf viewing facility at PLNWR in Columbia, NC. The red wolf viewing facility will include the construction of several enclosures to house red wolves, including a natural environment enclosure designed to showcase red wolves to the visiting public. Additional information on the red wolf viewing facility can be found at (www.crowdrise.com/enclosure/fundraiser/redwolfcoalition).

Announcements

On June 23, 2011, the Red Wolf Recovery Program lost long-time friend and colleague Thom Lewis. Thom died in a plane crash on Eglin Air Force Base in the panhandle of Florida. Thom was a pilot for the U.S. Fish and Wildlife Service, primarily involved with migratory bird programs. From 1992 to 2008, Thom was the wildlife biologist for St. Vincent NWR where he oversaw the refuge's red wolf program. One of his many legacies is the more than twenty red wolf pups that were born at St. Vincent NWR, and were later transferred to participating SSP facilities across the nation, including the Red Wolf Recovery Area. The Red Wolf Recovery Program extends their deepest sympathies to the Lewis family.

The Red Wolf Recovery Program congratulates Justin Bohling for successfully defending his dissertation and completing his PhD degree in Natural Resources in the Department of Fish and Wildlife Resources at the University of Idaho. Justin's dissertation is entitled "Exploring the patterns and mechanisms of red wolf (*Canis rufus*) hybridization in North Carolina." Lisette Waits, PhD, served as Justin's advisor and Committee Chair.

The Red Wolf Recovery Program also congratulates Justin Dellinger for successfully defending his thesis and completing his MS degree in Biology in the Department of Biological Sciences at Auburn University. Justin's thesis is entitled "Foraging and spatial ecology of red wolves (*Canis rufus*) in northeastern North Carolina." Troy Best, PhD, served as Justin's advisor and Committee Chair.

The U.S. Fish and Wildlife Service continues the investigation of the suspected illegal take of two red wolves found dead in two different locations in Hyde County, North Carolina, and one red wolf found dead on Alligator River National Wildlife Refuge in Dare County, North Carolina. Contributions from various organizations and individuals have increased the amount of a reward of up to $15,000 for information directly leading to an arrest, a criminal conviction, a civil penalty assessment, or forfeiture of property on the subject or subjects responsible for the suspected unlawful take of these red wolves. The red wolf is protected under the Endangered Species Act. The maximum criminal penalties for the unlawful taking of a red wolf are one year imprisonment and $100,000 fine per individual. Anyone with information on the deaths of these red wolves or any others, past or future, is urged to contact Special Agent Sandra Allred at (919) 856-4786, Refuge Officer Chris Smith at (252) 926-4021, or North Carolina Wildlife Resources Commission Officer Robert Wayne at (252) 216-8225.

Red Wolf
Recovery Program

Photo credit: Jeffrey Mittelstadt

2nd Quarter Report

January – March 2012

Coordinator: David R. Rabon Jr., PhD
Wildlife Biologists: Art Beyer, Chris Lucash, Ford Mauney, Michael L. Morse
Biological Technician: Ryan Nordsven
Public Affairs and Outreach Coordinator: Vacant
Administrative Assistant: Vacant
Intern (Caretaker): Alayna McGarry

www.fws.gov/redwolf

trackthepack.blogspot.com

www.facebook.com/redwolfrecoveryprogram

The Red Wolf Recovery Program

The red wolf (*Canis rufus*) is one of the most endangered canids in the world. Once occurring throughout the eastern and south-central United States, red wolves were decimated by predator-control programs and the loss and alteration of habitats. By the 1970s, these activities had reduced the red wolf population to a small area along the Gulf coast of Texas and Louisiana. To protect the species from extinction, the U.S. Fish and Wildlife Service initiated efforts to locate and capture as many red wolves as possible for the purposes of establishing a program to breed the species in captivity and one day reintroduce the species into a portion of its former range. More than 400 canids were captured in coastal areas of Texas and Louisiana, but only 17 were identified as pure red wolves. Fourteen of these wolves would become the founding members of the captive-breeding program and the ancestors of all red wolves existing today.

The first litter of red wolves born in captivity occurred in 1977. Within a few years red wolves were successfully reproducing in captivity, allowing the U.S. Fish and Wildlife Service to consider reintroducing the species in the wild. In 1987, four male-female pairs of red wolves were released in Alligator River National Wildlife Refuge (ARNWR) in northeastern North Carolina and designated as an experimental population. Since then, the experimental population has grown and the recovery area expanded to include four national wildlife refuges, a Department of Defense bombing range, state-owned lands, and private lands, encompassing about 1.7 million acres.

Adaptive Management

The recovery and restoration of red wolves requires the careful management of eastern coyotes (*C. latrans* var.) and occasionally wolf-coyote hybrids in the red wolf recovery area. The non-native coyotes spread across North Carolina to the red wolf recovery area in the early to mid-1990s. It soon was recognized that interbreeding between red wolves and eastern coyotes would produce hybrid offspring resulting in coyote gene introgression into the wild red wolf population, and that this introgression would threaten the restoration of red wolves. An adaptive management plan was developed to reduce interbreeding and introgression while simultaneously building the red wolf population. The adaptive management plan effectively uses techniques to capture and sterilize hormonally intact coyotes via vasectomy or tubal ligation, then releases the sterile canid at its place of capture to act as a territorial “placeholder” until the animal is replaced by wild red wolves. Sterile coyotes are not capable of breeding with other coyotes, effectively limiting the growth of the coyote population, nor are they capable of interbreeding with wild red wolves, limiting hybridization events. In addition, the sterile canid will exclude other coyotes from its territory. Ultimately, the placeholder canids are replaced by the larger red wolves either naturally by displacing the coyote or via management actions (e.g., removal of the coyote followed by insertion of wild or translocated wolves). Coyotes that are captured on private property are euthanized at the landowner’s request.

Currently, adaptive management efforts are making progress in reducing the threat of coyotes to the red wolf population in northeastern North Carolina. Other threats, such as habitat fragmentation, disease, and anthropogenic mortality, also are of concern in the restoration of red wolves. Efforts to reduce these threats are presently being explored.

Program Objectives

The current recovery plan (U.S. Fish and Wildlife Service, 1990) specifies the following objectives:

1) Establish and maintain at least three red wolf populations via restoration projects within the historic range of the red wolf. Each population should be numerically large enough to have the potential for allowing natural evolutionary processes to work within the species. This must be paralleled by the cooperation and assistance of at least 30 captive-breeding facilities in the United States.
2) Preserve 80% to 90% of red wolf genetic diversity for 150 years.
3) Remove threats of extinction by achieving a wild population of approximately 220 wolves and a captive population of approximately 330 wolves.

4) Maintain the red wolf into perpetuity through embryo banking and cryogenic preservation of sperm.

The Red Wolf Population

We estimate between 90 and 110 red wolves in the Red Wolf Recovery Area, but for the purposes of this report all population figures are comprised only of known canids (i.e., those that are regularly monitored through either a functioning radio-collar or surgically implanted abdominal radio transmitter). Additional wolves are likely present, but have not been captured/radio-collared or their continued presence otherwise confirmed.

Beginning with the first quarter of the fiscal year 2012 (FY12) we have changed the way we report population and pack numbers. This change more accurately represents the managed population of canids that are part of our efforts to restore red wolves. The managed population includes wolf packs (i.e., packs consisting entirely of wolves) and mixed packs (i.e., packs of a wolf and coyote pair). A pack is defined as at least two known canids cooperatively inhabiting an established territory.

Population and Territory Status

A total of 77 known red wolves occupied the Red Wolf Recovery Area (i.e., 1.7 million acres in five counties in northeastern North Carolina) at the end of the second quarter of our fiscal year 2012 (FY 12). The population includes 15 wolf packs (comprised of 53 wolves and 13 breeding pairs), and 10 mixed packs (comprised of 10 wolves and 10 coyotes). An additional 14 wolves are not known to be associated with a pack. A total of 58 sterile coyotes were monitored in the Red Wolf Recovery Area at the end of this quarter.

Pairings

One breeding pair of red wolves was lost and three wolf pairs were formed during the quarter. The breeding pair loss happened when the breeding male left his territory and mate, and formed a new pair with a neighboring female wolf.

Five new mixed pairs (wolf-coyote) were reported during the quarter when program biologists were able to capture, sterilize, and release five coyotes that had previously paired with single wolves with established territories.

Two captured red wolves (1 male, 1 female) were placed together in a soft-release acclimation pen in February in an attempt to form a new pair. Their release is planned for early April.

Captures and Radio Telemetry Marking

Thirty-six red wolves were captured during the quarter, 18 of which were first-time captures. All captured wolves were fitted or re-fitted with radio-telemetry collars (VHF or GPS) or surgically implanted with abdominal radio transmitters. All but three of the wolves (1 male, 2 females) were released. The two females are being temporarily held to administer pregnancy tests, and one female was paired with the male and placed in a soft-release acclimation pen. These three wolves are scheduled to be released in early April. Captured red wolves consisted of 22 males and 14 females; 11 adults (> 2 years of age), nine juveniles (1-2 years of age), and 16 pups (< 1 year of age).

Twenty-six coyotes were captured and released during the quarter, 20 of which were first-time captures. The first-time captured coyotes were sterilized before being radio-collared and released. The other six coyotes were previously sterilized; their radio collars were replaced before release. Two of the six coyotes were recaptures in which we had lost contact; therefore, they were not included in the previous quarter's count. Captured coyotes consisted of 11 males and 15 females.

Dispersals and Displacements

One known juvenile male wolf dispersed from his natal territory during the quarter.

Two sterile coyotes (1 male, 1 female) were displaced from their respective territories by a male and female wolf during the quarter.

Mortalities

One male wolf from the Red Wolf Recovery Area is known to have died during the quarter. He was struck by a vehicle.

Four sterile, radio-collared coyotes also were known to have died during the quarter. Two of the deaths were the result of gunshot, and one death was the result of vehicle collision. The cause of death could not be determined for one of the coyotes. Two of these four coyotes had not been listed in the previous quarter's population count; one had been lost to contact before it was discovered dead, the other was a new capture in the current quarter before being struck by a vehicle.

Disappearances

The Red Wolf Recovery Program lost radio contact with six wolves (4 males, 2 females), and three coyotes (3 females) during the quarter.

Pack Summaries

The Pack Summaries *section has been indefinitely discontinued due to recent events and current circumstances involving the apparent illegal take of red wolves within the Red Wolf Recovery Area.*

Collaborations

Research

The Red Wolf Recovery Program provided financial and in-kind support for collaborative research with scientists at other institutions, including universities, interagency divisions, and non-government research organizations. These investigations required project staff to assist outside researchers and graduate students in their efforts to better understand red wolf ecology, ecosystem function, and conservation efforts.

Project Title: Prevalence of cystic endometrial hyperplasia and its effect on reproduction in the red wolf.
Graduate Student: n/a
Committee Chair/Principal Investigators: Kadie Anderson, DVM, Point Defiance Zoo & Aquarium

Project Title: Inbreeding and mate choice in wild red wolves.
Graduate Student: Kristin Brzeski (PhD student)
Committee Chair/Principal Investigator: Sabrina Taylor, PhD, Louisiana State University

Project Title: Evaluation of reproductive function in female red wolves following contraception with Deslorelin or Deslorelin and MGA.
Graduate Student: n/a
Committee Chair/Principal Investigators: Karen Goodrowe-Beck, PhD, Point Defiance Zoo & Aquarium

Project Title: Identifying management procedures to reduce red wolf-coyote interactions in eastern North Carolina.

Graduate Student: Joseph Hinton (PhD student)
Committee Chair/Principal Investigator: Michael Chamberlain, PhD, University of Georgia

Project Title: Use of stable isotope analysis to elucidate predation patterns of sympatric canids.
Graduate Student: Anne-Marie Hodge (MS student)
Committee Chair/Principal Investigator: Brian Arbogast, PhD, University of North Carolina at Wilmington

Project Title: Red wolf conservation and deer hunting: the struggles and the common ground.
[This project is part of a master's thesis creating a nonprofit (WildSides.org) that develops interactive, dynamic and internet-based documentaries about human/wildlife conflict providing a forum for ongoing learning, discussion and collaboration.]
Graduate Student: Jeffrey Mittelstadt (MA student)
Committee Chair: Penny Abernathy, MBA, MS, Knight Chair in Journalism and Digital Media Economics, School of Journalism and Mass Communication, University of North Carolina at Chapel Hill

Project Title: Evaluating potential effects of widening US Highway 64 on red wolves, Washington, Tyrrell, and Dare Counties, North Carolina.
Graduate Student: Christine Proctor (PhD student)
Committee Chair/Principal Investigator: Michael R. Vaughan, PhD, Virginia Polytechnic Institute and State University (Virginia Tech)

Project Title: Sperm morphology and motility of the red wolf (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigators: Albrecht Schulte-Hostedde, PhD, Laurentian University, and Gabriela Mastromonaco, PhD, Toronto Zoo

Publications

The following publications have gone to print in this quarter. A complete list of publications related to red wolves can be found at http://www.fws.gov/redwolf/biblio.html.

Beeland, T.D. 2012. Night-hunting coyotes in N.C. risky for red wolves. Scientific American. [published online March 27 at http://blogs.scientificamerican.com/guest-blog/2012/03/27/night-hunting-coyotes-in-n-c-risky-for-red-wolves/].

Hutt, C. 2012. Song of the south: restoring and protecting America's 'other wolf.' Wolf Print 45:16-18.

Schmitt, E. and S. Wallace. 2012. Shape change and variation in the cranial morphology of wild canids (*Canis lupus*, *Canis latrans*, and *Canis rufus*) compared to domestic dogs (*Canis familiaris*) using geometric morphometrics. International Journal of Osteoarchaeology [early publication online at http://onlinelibrary.wiley.com/doi/10.1002/oa.1306/abstract].

Sparkman, A.M., J.R. Adams, T.D. Steury, L.P Waits, D.L. Murray. 2012. Evidence for a genetic basis for delayed dispersal in a cooperatively breeding canid. Animal Behaviour [early publication online at http://www.sciencedirect.com/science/article/pii/S0003347212000747].

Stoskopf, M. 2012. Carnivore restoration. In L. Boitani and R.A. Powell (Eds.), Carnivore Ecology and Conservation. Oxford University Press.

Presentations

Bohling, J.H. 2012. The impacts of hybridization on wildlife conservation: the case of the red wolf. Invited Seminar, School of Forest Resources, Penn State University. January, State College, Pennsylvania.

Hinton, J.W. 2012. Coyote space use and habitat selection in eastern North Carolina. Warnell School of Forestry and Natural Resources Graduate Student Symposium, February 16, Athens, Georgia.

Hinton, J.W. 2012. Coyote in the southeast; research and management. Conservation Volunteer Program, Marine Corps Base Quantico, March 17, Quantico, Virginia.

Staff and Volunteers

The Red Wolf Recovery Program employs eight full-time staff, including the program coordinator, four wildlife biologists, a biological technician, a public affairs/outreach coordinator, and an administrative assistant. The public affairs/outreach coordinator and administrative assistant positions are currently vacant. The Red Wolf Recovery Program also benefits from an unpaid intern (Caretaker).

Outreach

Staff from the Red Wolf Recovery Program conduct presentations and attend events to inform and educate the public on the conservation needs of the red wolf and the restoration efforts of the Red Wolf Recovery Program. As part of our effort to assist educators, red wolf "discovery boxes" that include materials about the red wolf are distributed to educational facilities. The distribution of discovery boxes is managed by the Red Wolf Coalition (see Partnerships). Requests for discovery boxes should be made to kwheeler@redwolves.com.

The Red Wolf Recovery Program also seeks to achieve a quality visitor and participant experience in the U.S. Fish and Wildlife Service's priority recreational uses on National Wildlife Refuges. Our outreach efforts focus on four of the six program elements, including wildlife observation, wildlife photography, environmental education, and interpretation, and are conducted frequently in partnership with ARNWR and PLNWR educators and volunteers.

Presentations

Date	Location	Audience	Length	Attendance	Presenter
February 4	Hyde County	Hyde County Hunters (Youth Hunt Day)	4 hrs	~250	C. Lucash F. Mauney
March 28	ARNWR	Outer Banks Visitors Bureau	2 hrs	6	D. Rabon

Howlings

Date	Location	Event	Length	Attend	Presenter
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Website / Social Media

Information on the red wolf and the Red Wolf Recovery Program can be found on our website at www.fws.gov/redwolf.

The Red Wolf Recovery Program also maintains several social media sites. Our Facebook page (www.facebook.com/redwolfrecoveryprogram) connects our program with "friends" from around the world and informs them of the conservation efforts of the Red Wolf Recovery Program. Using Twitter, the Red Wolf Recovery Program connects with our "followers" by providing real-time information about all things red wolf. Follow us on Twitter at www.twitter.com/redwolfrecovery. Users can view and download high

resolution pictures related to red wolves and the Red Wolf Recovery Program on our Flickr page (www.flickr.com/photos/trackthepack). Lastly, discover, watch, and share videos of red wolves on our YouTube site (www.youtube.com/trackthepacktube).

The Red Wolf Recovery Program also has a weblog that highlights the efforts of the Red Wolf Recovery Program staff in the conservation of the red wolf. The weblog combines text, images, videos, and links to other media related to its topic. The content includes educational, informational, and general journal entries written by program staff, and allows readers to leave comments in an interactive format. The weblog can be found at trackthepack.blogspot.com.

Media Inquires

The Red Wolf Recovery Program responded to numerous media inquiries during this quarter, mainly on the issue of the proposed rule by the North Carolina Wildlife Resources Commission to allow the hunting of coyotes at night. Media inquiries came from the journalists and science writers associated with Scientific American, Fayetteville Observer (Fayetteville, NC), Daily Reflector (Greenville, NC), Charlotte Observer (Charlotte, NC), News and Observer (Raleigh, NC), and National Public Radio (Chapel Hill, NC). Publications associated with these inquiries can be found reposted on our Facebook page and blog.

Partnerships

Species Survival Plan (SSP)

Species Survival Plan (SSP) captive facility coordination is based at Point Defiance Zoo & Aquarium (PDZA) in Tacoma, Washington. The SSP currently coordinates 41 captive red wolf sites at zoos and nature centers housing about 166 wolves. The following information is based on activities completed or conducted by the SSP Coordinator during the quarter reported. Additional information on the SSP can be found at redwolfssp.org.

The SSP Coordinator reported numerous correspondence and communications regarding red wolves, including coordinating the transfer of wolves to North Carolina State University as an SSP approved facility, providing a letter of support to the Endangered Wolf Center's (Eureka, MO) Conservation through Literacy campaign, and encouraging SSP cooperators to comment on the North Carolina Wildlife Resources Commission's proposal to allow the hunting of coyotes at night. The SSP Coordinator also completed AZA surveys related to SSP and field conservation and animal program sustainability, and provided input to AZA Population Management Center for survival statistics. Lastly, the SSP coordinator responded to a number of researchers inquiring about red wolf related issues and research, such as Progressive Retinal Atrophy (PRA), supernumary dentition, pup fostering, and founding-line survival.

For the quarter, the SSP Coordinator reported attending a meeting on gamete banking at St. Louis Zoo (St. Louis, MO), completing and distributing the 2011 studbook, submitting an application for export permit to provide additional samples for study (Laurentian University and Toronto Metro Zoo) to evaluate the effects of inbreeding on several sperm morphology parameters, completing reproductive ultrasound examinations on female wolves in conjunction with a study (PDZA) to evaluate the prevalence of cystic endometrial hyperplasia in a subset of the SSP population of red wolves, and completing blood sera collection for vaccine titer study.

Island Propagation Sites

The U.S. Fish and Wildlife Service utilizes island sites to propagate red wolves and contribute to the restoration of a wild red wolf population, primarily by inserting island-born wolves into the wild population as a means to augment the wild red wolf gene pool with "under-represented" genes from the captive population. Currently, the Red Wolf Recovery Program cooperates with St. Vincent National Wildlife Refuge in maintaining a breeding pair of red wolves on an island site.

Red Wolf Coalition

The Red Wolf Coalition (RWC), a non-profit education organization based in Columbia, NC, advocates for the long term survival of wild red wolf populations by teaching about red wolves and by engaging the public in red wolf conservation. The RWC's web site (www.redwolves.com) provides information about the history, biology, and ecology of red wolves, as well as news about red wolf restoration. The RWC gives red wolf programs to school groups, professional organizations, university students, and other groups. The RWC also conducts workshops for teachers and non-formal educators, including people seeking certification in environmental education.

The RWC reports that preliminary construction of the grounds around the red wolf viewing facility at PLNWR in Columbia, NC has begun. Construction of the red wolf viewing facility and enclosures is expected to begin in April. In addition, the RWC Executive Director reported that the RWC and General Mills Corporation (Minneapolis, MN) are working together on fundraising, branding, and expanding the reach and effectiveness of the organization. The RWC Executive Director also met with the Marketing Director of North Carolina State University to explore educational opportunities at university sporting events.

The RWC and NC Museum of Life and Science (Durham, NC) are co-sponsoring the "Wolves and Wild Lands in the 21st Century" exhibit which will open to the public at the museum in April. The exhibit will highlight wolves and their struggle to survive, the cultural and economic pressures which continue to shape their existence, and the challenges that wolves and people face coexisting in the same place. This visually captivating exhibit features six canid specimens - five wolves and a coyote. Information about the exhibit can be found at http://www.ncmls.org/visit/events/wolves-wild-lands.

The RWC Executive Director reported conducting several education programs during the quarter, including a presentation at PLNWR to a group of 15 people from the North Carolina Museum of Natural Sciences; a presentation in Plymouth (NC) to 20 students from Exploris School (Raleigh, NC); and, participating in a conference call about red wolves with 3rd graders from Windsor Elementary School (Windsor, VA). The RWC Executive Director also presented statements in opposition of the North Carolina Wildlife Resources Commission's proposal to allow the hunting of coyotes at night at two public hearings held in March.

The RWC also has three Red Wolf Discovery Boxes for all grade levels. These boxes are filled with a variety of hands-on items, activities and artifacts that help students explore the world of red wolves. The red wolf curriculum *Far Traveler* and a variety of books and other resources also are included. Contact Kim Wheeler at 252-796-5600 or kwheeler@redwolves.com for more information or to reserve your Red Wolf Discovery Box.

Announcements

The Red Wolf Recovery Program congratulates Justin McVey for successfully defending his thesis and completing his M.S. degree in Fisheries, Wildlife, and Conservation Biology in the Department of Forestry and Environmental Resources at North Carolina State University. Justin's thesis is entitled "Assessing food habits of red wolves (*Canis rufus*) and coyotes (*Canis latrans*) in eastern North Carolina." Christopher E. Moorman, PhD, and David T. Cobb, PhD, served as Justin's advisors and Committee Co-Chairs.

The Red Wolf Recovery Program congratulates the following researchers for successfully competing in PDZA's Conservation Committee Grants:

- Kristin Brzeski, a PhD student at Louisiana State University, for projects entitled "Examining genetic variation in pre-Columbian red wolves" ($4000); and, "Inbreeding depression, MHC variation, and mate choice in wild red wolves" ($5000).

- Karen Goodrowe-Beck, PhD, PDZA, for her project entitled "Evaluation of reproductive function in female red wolves following contraception with Deslorelin or Deslorelin and MGA" ($5000).

- Kadie Anderson, DVM, PDZA, for her project entitled "Prevalence of cystic endometrial hyperplasia and its effect on reproduction in the red wolf" ($7487).

- Craig Standridge, PDZA, for his project entitled "2012 Red Wolf SSP Education Summit" ($1500).

The U.S. Fish and Wildlife Service is investigating the suspected illegal take of several red wolves found dead in the Red Wolf Recovery Area (Dare, Hyde, Tyrrell, Washington, and Beaufort Counties, NC). Contributions from various organizations and individuals have resulted in a reward of up to $15,000 for information directly leading to an arrest, a criminal conviction, a civil penalty assessment, or forfeiture of property on the subject or subjects responsible for the suspected unlawful take of these red wolves. The red wolf is protected under the Endangered Species Act. The maximum criminal penalties for the unlawful taking of a red wolf are one year imprisonment and $100,000 fine per individual. Anyone with information on the deaths of red wolves is urged to contact Special Agent Sandra Allred at (919) 856-4786 or North Carolina Wildlife Resources Commission Officer Robert Wayne at (252) 216-8225.

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

RIN 1018-AC03

Endangered and Threatened Wildlife and Plants; Revision of the Special Rule for Nonessential Experimental Populations of Red Wolves in North Carolina and Tennessee

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: The Service amends the special rule for the nonessential experimental populations of red wolves (*Canis rufus*) in North Carolina and Tennessee to; revise and clarify the incidental take provision; apply the incidental take provision to both reintroduced populations; revise the livestock owner take provision; apply the livestock owner take provisions to both reintroduced populations; add harassment and take provisions for red wolves on private property; revise and clarify the vaccination and recapture provision; and apply the same taking (including harassment) provisions to red wolves outside the experimental population area, except for reporting requirements.

EFFECTIVE DATE: April 13, 1995.

ADDRESSES: The complete file for this rule is available for inspection, by appointment, during normal business hours at the Asheville Field Office, U.S. Fish and Wildlife Service, 330 Ridgefield Court, Asheville, North Carolina 28806.

Requests for the summary report on the 5-year experimental reintroduction at the Alligator River National Wildlife Refuge (Alligator River) should be sent to the Alligator River National Wildlife Refuge, P.O. Box 1969, Manteo, North Carolina 27954.

FOR FURTHER INFORMATION CONTACT: Mr. V. Gary Henry, Red Wolf Coordinator, at the above Asheville, North Carolina, address (Telephone 704/665–1195, Ext. 226).

SUPPLEMENTARY INFORMATION

Effective Date

The usual 30-day delay between date of publication of a final rule and its effective date may be waived for good cause, as provided by 50 CFR 424.18(b)(1) and the Administrative Procedure Act (5 U.S.C. 553(d)(3)). The Service finds that this period be waived for this rule as its immediate promulgation is necessary to avoid potential conflict between Federal provisions for the taking of red wolves on private property and corresponding State of North Carolina provisions that become effective on January 1, 1995.

Background

A proposed rule to introduce red wolves into Alligator River National Wildlife Refuge (Alligator River), Dare County, North Carolina, was published in the Federal Register July 24, 1986 (51 FR 26564). A final rule making a determination to implement the proposed action with some modifications was published November 19, 1986 (51 FR 41790). The red wolf population in Dare County and adjacent Tyrrell, Hyde, and Washington Counties was determined to be a nonessential experimental population according to section 10(j) of the Endangered Species Act of 1973, as amended (Act). A revision published November 4, 1991, added Beaufort County to the list of counties where the experimental population designation would apply (56 FR 56325). The status of the population was to be reevaluated within 5 years, and the process was to include public meetings.

A proposed rule to introduce red wolves into the Great Smoky Mountains National Park (Park), Haywood and Swain Counties, North Carolina; and Blount, Cocke, and Sevier Counties, Tennessee, was published in the Federal Register August 7, 1991 (56 FR 37513). A final rule making determination to implement the proposed action with some modifications was published November 4, 1991 (56 FR 56325). This population was also determined to be a nonessential experimental population according to section 10(j) of the Act. Graham, Jackson, and Madison Counties, North Carolina; and Monroe County, Tennessee, were also included in the experimental designation because of the close proximity of these counties to the Park boundary. The reintroduction potential of the Park was to be assessed after a 10- to 12-month experimental phase. A positive assessment would result in initiation of a permanent reintroduction attempt.

The red wolf is an endangered species that is currently found in the wild only as experimental populations on the Service's Alligator River and Pocosin Lakes National Wildlife Refuges and adjacent private lands in Dare, Hyde, Tyrrell, and Washington Counties, North Carolina; and in the Park in Swain County, North Carolina, and Blount and Sevier Counties, Tennessee; and as an endangered species in three small island propagation projects located on Bulls Island, South Carolina; Horn Island, Mississippi; and St. Vincent Island, Florida. These five carefully managed wild populations contain a total of approximately 60 animals. The remaining red wolves are located in 31 captive-breeding facilities in the United States. The captive population presently numbers approximately 180 animals.

Following are summaries of the results from the two experimental reintroductions. A more detailed summary for Alligator River is available (see **ADDRESSES** section) as Progress Report No. 6, entitled ''Reestablishment of Red Wolves in the Alligator River National Wildlife Refuge, North Carolina, 14 September 1987 to 30 September 1992.''

Alligator River 5-Year Summary

The 5-year experiment to reestablish a population of red wolves in Alligator River in northeastern North Carolina ended October 1, 1992.

From September 14, 1987, through September 30, 1992, 42 wolves (adults—10 males, 9 females; yearlings—1 female; pups—12 males, 10 females) were initially released on 15 occasions. Four releases were conducted in 1987, two in 1988, five in 1989, two in 1990, one in 1991, and one in 1992. As of September 30, 1992, there were at least 30 free-ranging wolves in northeastern North Carolina.

Animals were initially released as members of seven adult pairs, an adult and a yearling, an adult and a pup, five families, and one sibling pair. Adults are defined as animals 24 months or greater in age, yearlings are between 12 and 24 months of age, and pups are 12 months or less in age. Released adults ranged in age from 2.25 years to 7.33 years.

Wide-ranging movements that created management situations or led to the death of some animals soon after release were common. Of the 31 releases of adults and 22 releases of pups, 18 adults and 10 pups either had to be returned to captivity or died within 2 months. Length of acclimation, release area, location of resident wolves, and type of social group released all affected a wolf's probability of successfully establishing itself in the wild.

Of the 42 wolves released, 22 died; 7 were returned to captivity for management reasons; 11 were free-ranging through September 30, 1992; and the fates of 2 are unknown. Length of time in the wild varied from 16 days to 3.5 years.

Reintroduced wolves were killed by one of at least seven mortality factors. Vehicles (n = 8), intraspecific aggression

(n = 5), and drownings (n = 4) were the most significant sources of mortality. It is a measure of the program's success that all but two of the deaths were natural or accidental, not as a result of any irresponsible action by a private citizen.

A minimum of 22 wolves were born in the wild. These animals were members of eight litters produced by 11 adults (6 males, 5 females). Two litters were produced in 1988, at least one in 1990, four in 1991, and at least one in 1992. No pups were born in the wild during 1989 because there were no adult pairs together during the breeding season.

Only two wild-born wolves died, and the fate of one is unknown. As of September 30, 1992, wild-born wolves accounted for 63 percent of the known population (19 of 30).

Of the 11 adults that bred in the wild, 1 was wild-born and 10 were captive-born. Wild-born offspring are evidence that captive-born-and-reared adults can make the transition from captivity to life in the wild.

As expected, wild-born pups exhibited wide-ranging movements as they dispersed from natal home ranges. These animals, with the exception of one female, traveled up to 192 km before establishing new home ranges on private land south or west of Alligator River. One female was killed by a vehicle before she established a new home range. Dispersal age ranged between 7 and 22 months. The youngest dispersers were siblings that left their natal home range after their parents were returned to captivity. Likewise, another female dispersed at a young age after her mother was returned to captivity. It is likely that some or all of these pups would not have dispersed had their families remained intact.

Twenty-four of the released wolves were recaptured 63 times, and 17 of the wild-born wolves were recaptured 39 times. Most recaptures were necessary in order to meet program objectives (replace radio collars, place a specific wolf with a mate, translocate an animal to a suitable site, etc.). Every management problem was resolved without inflicting significant long-term damage to animals and with little or no inconvenience to residents of the area.

Captive breeding was an integral component of the reintroduction. Since 1986, 79 wolves have been held in captivity at Alligator River for varying periods of time. As of September 30, 1992, 10 wolves were in captivity. During the 5-year experiment, 20 captive adult pairs produced 34 pups. With access to 12 pens, Alligator River will continue to be an important component of the red wolf captive-breeding program.

By almost every measure, the reintroduction experiment was successful and generated benefits that extended beyond the immediate preservation of red wolves to positively affect local citizens and communities, larger conservation efforts, and other imperiled species. During the last 5 years, four important points surfaced:

1. Since every management problem was resolved without inflicting long-term damage to animals and with little inconvenience to residents of the area, it is evident that red wolves can be restored in a controlled manner.

2. Significant land-use restrictions were not necessary in order for red wolves to survive. Indeed, hunting and trapping regulations for Alligator River remained unchanged or were further relaxed during the experiment. Additionally, no restrictions were needed in order for red wolves to survive on private land.

3. Red wolves and sportsmen can coexist. Many hunters and trappers expressed support, while others actively contributed to the success of the experiment by reporting sightings of red wolves.

4. The reintroduction area, which encompasses about 250,000 acres (111,750 hectares), probably cannot support 30 red wolves for an extended period of time. Dispersal outside the reintroduction area by wild-born red wolves has occurred and will continue. Efforts will be made to work with private landowners to allow wolves on private property. In addition to dispersal, the future of the red wolf population is threatened by its smallness; many events (e.g., disease outbreaks) can cause extinction of small populations.

Increasing the size of the wolf population minimizes threats to its survival. The primary factor limiting population size is the size of the reintroduction area. A larger reintroduction area would provide habitat for dispersing wolves and provide the Service with opportunities to release additional wolves. Fortunately, the reintroduction area can easily be enlarged by adding to the project the 112,000-acre (45,327-hectare) Pocosin Lakes National Wildlife Refuge (Pocosin Lakes). Purchased in 1990 and located in Washington, Tyrrell, and Hyde Counties, North Carolina, Pocosin Lakes is ideal for probably 15 to 25 wolves because of its large size, remoteness, abundant prey populations, and proximity to Alligator River.

Meetings with the public and local governments were held to present the results of the first 5 years and to solicit input on a proposal to maintain the current population and expand the reintroduction westward to encompass Pocosin Lakes beginning in 1993. The seven public meetings were held in the communities of Engelhard, Manteo, Stumpy Point, East Lake, Columbia, Swanquarter, Washington, and Plymouth. Attendance at these meetings ranged from 7 to 90 people at each and totaled 146 at all locations. Meetings were also held with the county commissioners in Washington, Dare, Beaufort, Tyrrell, and Hyde Counties.

Reintroductions are generally supported by local, State, and Federal agencies; elected officials; and the general public, except for some private landowners and the county boards of commissioners in Hyde and Washington Counties, North Carolina. Most people who commented supported the restoration project, although some expressed concern about the effect of red wolves on activities on private land. The Service assured them that, because free-ranging wolves are legally classified as members of an experimental nonessential population, the wolves would not negatively impact legal activities on private or Federal land.

Some citizens used the meetings to express frustration about other matters involving the Service. No significant complaints were voiced specifically about the red wolf reintroduction experiment. However, Hyde and Washington Counties did pass resolutions opposing red wolf project expansion. These resolutions seemed to be based on anti-government sentiment and a fear of prohibitions on private land use.

After consideration of the results from the 5-year experimental reintroduction and public input received in public meetings and meetings with State and local governments and agencies, the Service determined that it would maintain the present populations at Alligator River and has expanded this population with reintroductions at Pocosin Lakes beginning in 1993. The reintroductions at Pocosin Lakes are within counties previously designated for the experimental population and require no changes in the existing rule.

Park 1-Year Summary

On November 12, 1991, the Service, in cooperation with the National Park Service (Park Service), experimentally released a single family group of red wolves into the Cades Cove area of the Park. This release was designed to assess the feasibility of eventually establishing a self-sustaining red wolf population on Park Service and

surrounding U.S. Forest Service property. The experimental period ended in late September 1992 with the capture of the remaining three members of the release group.

Specific technical objectives of the experimental release were to document and respond to movements and activities of the wolves in mountainous terrain and in the presence of high human activity, livestock interests, and an increasing coyote population. However, another objective was to establish an informative and cooperative relationship with the involved agencies and local citizens. Through continuous telemetric contact, direct and relayed sightings, and the dedicated efforts of project personnel, valuable information was gathered with respect to all of these categories; some problems were encountered as well.

Cades Cove is unique within the Park; it possesses a great diversity and abundance of prey species, making it highly attractive to a large predator. As a result, the average home range for the four released wolves was 15 km^2 (3,700 acres), scarcely larger than Cades Cove itself. As yet, an accurate prediction of red wolf home ranges for habitat typical of the other 99.3 percent of the Park cannot be made. Wolves made exploratory movements up to 16 km (10 miles) from the release site. Individuals strayed off Park property (less than 5 miles or less than 8 km) four times. Twice they were recaptured within several hours, and twice they returned of their own accord within 24 hours. The primary prey species taken by the wolves were deer, rabbit, ground-hog, and raccoon. Samples are currently being analyzed for percentages and seasonal variation.

Wolves were sighted on numerous occasions by visitors and project personnel throughout the experiment. This was somewhat expected in an area where prey species are extremely visible and comfortable with the intense attention of as many as 15,000 visitors daily. However, the two adult wolves, especially the male, repeatedly tolerated people at close distances. This was attributed to the amount of time (e.g., 6 years for the male) that the adults had spent in captivity. The male was eventually recaptured and removed from the experiment in late January 1992. The female tolerated human presence to a lesser degree, but she presented no problems and was allowed to roam free for the duration of the experimental period. The two female pups were often sighted crossing roads or, at a distance, hunting in pastures. They developed an increasing wariness to human activity as they spent more time in the wild. The behaviors of these wolves support the theory that younger wolves, with minimal exposure to human contact, make better release candidates.

The private land surrounding the Park and throughout the Southern Appalachians supports a variety of livestock interests. The perceived potential economic threat of a large predator is perhaps the single greatest political barrier to establishing a self-sustaining red wolf population in the Southern Appalachians. The documentation and management of the wolves' interaction with domestic livestock is likely to be a major factor in deciding whether to expand the project. Thus, a $25,000 depredation account was established to compensate livestock owners for losses.

Throughout the experiment, the adult male was responsible for taking one chicken and three domestic turkeys in two separate incidents. The remaining three wolves took one of five injured or missing newborn calves. One additional depredation attempt occurred but did not result in injury to the calf. Reimbursements for the chicken and the calf totaled $253. Offers to reimburse for the turkeys were declined by the owner.

Cades Cove supports a 300-head black angus cattle-breeding operation, leased to a private stock owner. During the 6-month calving season, the wolves and calving operation were intensely monitored. The wolves were located disjunct from five of six attempted depredations. Day and night (using night-vision equipment) visual observations revealed cooperative hunting by small groups of coyotes. Nightly spotlight observations by the stock owner revealed continuous coyote activity in calving pastures. Accurate records of lost calves prior to the experimental release of wolves were not kept. Estimates by the stock owner indicated approximately five to ten calves per year were lost to bears, coyotes, and other predators/scavengers.

Of significance is that all of the six depredation attempts during the experimental release involved calves less than 1 week old, and all the events occurred along wood lines away from the main herd of cattle. Project personnel began assisting the stock owner in moving newborn calves into the main herd, and no further depredations by coyotes or wolves occurred.

Prior to the red wolf release, the Service contracted the University of Tennessee to conduct a census of coyotes in the Park and to study interactions between resident coyotes and released wolves. Seven coyotes were outfitted with telemetry collars and were monitored for 18 months, or until they permanently left the study area. Only one coyote remained ''on the air'' in Cades Cove by the time the wolves were released. This collar expired 3 months later. Interaction data was then gathered by direct observation.

Initial information indicated aggressive behavior between the adult wolves and resident coyotes, with the wolves apparently dominating. After the removal of the adult male wolf, greater numbers determined the dominating species.

In preparation for the experimental release, project and Park personnel met with area business, citizenry, and natural resource organizations for comment on the proposal. Modifications to the release plans included the addition of a ''non-injurious harassment clause'' to the experimental rule package, prevention of reproduction in the wild, immediate recapture of wolves straying off Park property, and recapture of all wolves at the end of the experiment.

To facilitate information exchange, an information committee (composed of representatives from Federal and State wildlife resource agencies, Farm Bureau Federations, and conservation organizations) was established. The Heartland Series, a local television environmental program, produced a documentary entitled ''Front Runner,'' focusing on the reestablishment effort in the Southern Appalachians. The ''Front Runner'' video, a teacher's guide, and an activity poster were distributed free to all requesting educational institutions. The project gained national television exposure on ''Zoo Life with Jack Hanna,'' a weekly public education broadcast. Presentations and workshops were given at wildlife exhibitions and to a variety of groups from elementary to college students and to senior citizens. Other media contact included interviews with local and regional newspapers, popular magazines, free-lance writers, and television news teams.

During the final weeks of the experimental period, the Service reviewed and presented their findings to the Park Service and members of the information committee. The decision was made to proceed with a full reintroduction effort at a very conservative pace, with two releases in the fall of 1992.

On October 9, 1992, a family of six red wolves (two adults, four pups) were released into Cades Cove. To date, these wolves have shown restricted movements and food habits very similar to the experimental group. Within

several weeks after release, the adult pair had taken a large European wild hog—an exotic species in the Park.

On December 9, 1992, a second group of six wolves (two adults, four pups) was released from a remote backcountry site several miles east of Cades Cove. It is expected that these animals will be more difficult to track. However, they will provide needed information about the home range requirements of red wolves in habitat that is typical of the vast majority of the Park and surrounding Federal lands.

All released wolves will wear transmitters and will be monitored as closely as the experimental group. There are no scheduled plans to recapture these animals, except to replace aging transmitters in approximately 2 to 3 years.

The possibility of expanding the Park reintroduction to include adjacent national forest lands within the Nantahala and Pisgah National Forests in North Carolina, the Cherokee National Forest in Tennessee, and the Chattahoochee National Forest in Georgia will be evaluated over the next few years. This evaluation will include meetings with congressional representatives, State wildlife and agriculture agencies, Farm Bureau Federations, local agriculture and hunting interests, conservation organizations, county commissioners, and a variety of local organizations. A final decision will be made after public meetings in the local areas where reintroductions are proposed.

Special Rule Changes for Both Reintroductions

In the period since publication of the special rules for the experimental population introduced on Alligator River and the Park, published in the Federal Register on November 19, 1986 (51 FR 41796) and November 4, 1991 (56 FR 56333), it has become apparent that changes are needed in the rule for these populations. These changes will also provide consistency by treating both reintroductions the same.

The provision for taking red wolves incidental to lawful recreational activities (50 CFR 17.84(c)(4)(ii)) is revised and clarified by this final rule. Current policy at Alligator River applies this provision to all lawful activities, not just to recreational activities. For example, 11 wolves (includes 8 within the 5-year experimental release) have been killed by vehicles not involved in recreational pursuits, but certainly otherwise lawful. No problems have been encountered at Alligator River in the application of a more liberalized provision. Therefore, the Service deletes the word ''recreational.'' In addition, incidental take was defined at Alligator River as ''unavoidable, unintentional, and not resulting from negligent conduct lacking reasonable due care.'' This definition is changed for clarification and is included in the incidental take provision of the special rule.

The Service revised the rule for the Park reintroduction, based on input by the North Carolina Farm Bureau Federation which stated that livestock owners should be allowed to take red wolves engaged in livestock depredation. The Tennessee Citizens for Wilderness Planning supported the revision. The final rule permitted private livestock owners to harass red wolves actually engaged in the pursuit or killing of livestock on private lands. Such conflicts must be reported to the superintendent of the Park. Service or State officials will respond to these conflicts within 48 hours and attempt to live-capture the offending animals. If an early response by the Service or State officials results in a failure to capture offending animals, the livestock owner will be permitted to take the offending animal.

These provisions worked well in all five depredation incidents recorded the first year. Offending animals were recaptured, when necessary, and in at least two of the instances, private landowners did harass the animals away but did not take offending animals. Including the experimental release in 1991, there have been 17 incidents of animals moving out of the Park onto private lands. In three incidents, they returned on their own; in the other 14 incidents, they were recaptured. No indication of abuse of these provisions were encountered in these incidents. However, experience with offending animals has indicated potential problems.

It is highly objectionable to owners of livestock and pets to be unable to kill a predator that is engaged in killing their livestock or pets. This, in turn, leads to the erosion of public support for predator reintroductions, which is essential if this effort is to be successful. Also, there may be a time lapse before offending animals settle into a predictable pattern whereby they can be recaptured. During this time period, private landowners will not be allowed to take the animals themselves. The Service will respond to reported incidents within 48 hours. However, the existing special rule (§ 17.84(c)(4)(iv)) does not establish a definitive time when Service or State attempts to recapture the animal are deemed unsuccessful and the private landowner is then permitted to take the offending animals. This is a decision that must be made by the Service project leader or biologist in the field at the depredation location. Therefore, a rule revision provides that private landowners will be permitted to take offending animals upon written approval by the Service project leader or biologist on site of the depredation. This approval will be provided when the Service abandons attempts to capture the offending animal and will specify the authorized personnel (landowner and a limited number of his agents), the number of animals, and the time period (not to exceed 6 months). Also, private landowners will be allowed to take red wolves in the act of killing livestock or pets on private lands without the need for Service approval.

Experience at Alligator River and the Park indicates a need to extend the harassment and take provisions now in place for private livestock owners to include all private landowners. Wolves that come in close proximity to private residences may cause property damage by killing pets or removing and/or physically defacing small property items. In addition, private individuals may not want the animals on their property because they fear them or consider them a nuisance. Although currently not covered by such rule provisions, these stipulations have been implemented as reasonable law enforcement procedures. To date, there have been at least 15 incidents where animals on private property were harassed by private individuals. The special rule is revised to provide the legal basis for a provision now being implemented as a reasonable procedure.

Currently, there are at least 12 red wolves once present at Alligator River whose fate is unknown. Three of these wolves were observed but never captured. Transmitters malfunctioned on the other eight wolves. One animal, whose transmitter malfunctioned in December 1989, would now be 7 years old. The remaining 11 animals are 1 to 3 years of age, and contact with them was lost in 1991, 1992, or 1993. As wolves are great wanderers, it is possible that some of these five animals may have dispersed outside the experimental population boundaries (which could also happen with future animals). There is no possibility of such dispersing wolves mixing with populations of red wolves that have been classified as endangered, because the only existing red wolves in the wild are those introduced as experimental populations (and offspring) or those introduced (and offspring) onto isolated islands for propagation purposes. As a

result, animals dispersing outside the experimental population boundaries will not contribute to the conservation of the species.

As other resident wild canid populations are hunted and trapped, it is possible for a dispersing red wolf to be taken incidental to such lawful activities. Dispersing red wolves could also enter upon private property or attempt to kill livestock or pets. Providing greater protection for dispersing red wolves than that provided for red wolves within the experimental population boundaries would seriously erode the public support that is so essential for the success of reintroductions. Therefore, the special rule is revised to apply the same taking provisions to red wolves outside the experimental population boundaries as within, with one exception. This exception is that taking does not need to be reported to the refuge manager or Park superintendent. Such reporting will be encouraged to the degree possible, but it will not be required. It is impractical to inform the general population of such requirements outside the localized experimental population boundaries, and red wolves taken are not likely to be recognized as red wolves, even after such taking occurs and an animal is in hand.

The proposed rule for Alligator River provided for any person to take red wolves incidental to lawful recreational activities (51 FR 26564). Objections to this provision from the Defenders of Wildlife, the National Audubon Society, the Humane Society of the United States, and the National Wildlife Federation, based on lack of necessity and risk of misinterpretation, resulted in its deletion from the final rule. Instead, the enforcement policy of the Service was clarified in the preamble to the final rule to the effect that there would be no penalty for taking incidental to otherwise lawful activity providing the taking was unavoidable, unintentional, and did not result from negligent conduct lacking reasonable due care, and providing the taking was immediately reported to the refuge manager. Experience at Alligator River did detect a need for this provision and did not detect any misinterpretation of the policy by private citizens. Eleven red wolves were killed by vehicles; one wolf was killed in a trapping incident; and two were shot, one close to a private residence. The vehicle deaths were interpreted as incidental to lawful activity, which required little investigation. The trapping and shooting incidents were investigated and settlements were reached in two cases. In addition, the incidental take provision originally proposed and then deleted at Alligator River was included in the final rule for the Park. No taking of red wolves has occurred despite several instances of wolves visiting and having been seen on private lands. Therefore, this is additional evidence that the provision is not being misinterpreted by private individuals in order to indiscriminately take red wolves. As now promulgated for Alligator River, the incidental taking provision is ambiguous. The language used for defining incidental take under § 17.84(c)(4)(i) used the terms ''unavoidable'', ''unintentional,'' and ''lack of reasonable due care,'' which are subject to differing legal interpretations. Therefore, for this final rule the Service changes the provisions by stating that only intentional or willful take will be prosecuted on private lands. The final rule does not change the standard for lands owned or managed by Federal, State, or local government agencies.

The basic premise is that a red wolf that is incidentally taken in any type of legal activity on private lands will not be a violation of the special rule. However, a higher standard of conduct is expected on public lands, where the conservation of red wolves is an objective.

This incidental taking provision places trust in the public to be responsible citizens by obeying the special rule. The Service intends to revisit this issue to determine if excessive taking of red wolves is occurring because of the revised special rule.

Extensive review of the special rule during preparation of proposed and final revisions detected additional needs for clarification. The current special rule (§ 17.84(c)(10)) provides for the close monitoring of reintroduced populations, vaccination against diseases prior to release, and immediate recapture of wolves that need special care or that move off of Federal lands. Early in the project all animals were vaccinated because the entire population consisted of released animals. As the project progressed, released wolves and their progeny reproduced and expanded their range and population.

Obviously, vaccination cannot be implemented for wild wolves that have never been captured. Therefore, the special rule is clarified by revising the statement to the effect that all ''released or captured'' wolves will be vaccinated. At present, most wolves are vaccinated because the majority of wolves born in the wild are eventually captured. However, as populations continue to expand, the percentage of wolves that have not been captured will increase. Rule modifications also recognize that it may be impossible to capture some wolves. However, other provisions provide for the control of wolves that are causing conflicts but cannot be captured.

The intent of the special rule regarding the recapture of wolves leaving Federal lands was that it would be implemented only when such wolves caused conflicts and/or the landowner wanted the wolves removed. This intent is not clear. Red wolves had established themselves on private lands within 2 years (1989) of the first reintroduction releases, and several private landowners have agreed to allow the wolves to inhabit their property. Obviously, there is no need to remove wolves from private lands when the landowner has no problem with the wolves being there. Therefore, the special rule is modified to provide that all landowner requests to remove wolves from their property will be honored, but wolves that inhabit lands where the landowner agrees to allow them to reside will not be recaptured unless they cause a conflict.

Special Rule Changes for Alligator River

Experiences at Alligator River indicate that a need exists for application of the private landowner harassment and take provisions to this population as well. Twenty-seven incidents have been reported at Alligator River, some of which probably did not involve red wolves. The provisions could have been utilized in some of these incidents and may have altered the final outcome in a positive manner with regard to reducing adverse impacts and increasing public support. As these provisions have worked well in incidents in the Park population, with no difficulties encountered in their interpretation or application, this rule will extend these provisions to the Alligator River population.

The proposed rule called for the addition of Martin and Bertie Counties as a buffer zone. However, after further consideration, the Service has determined that this addition lacks sufficient justification and the counties are not being added to the designated reintroduction area (see Issue 7 in the following section).

Summary of Comments and Recommendations

In the November 24, 1993, proposed rule (58 FR 62086), all interested parties were requested to submit comments or recommendations that might contribute to the development of a final rule. Appropriate county, State, and Federal agencies; scientific, environmental, and

land use organizations; and other interested parties were notified and requested to submit questions or comments on the proposed rule. On December 6, 1993, the Service mailed copies of the proposed rule to 270 persons and organizations. A 30-day comment period was provided. Nine comments were received, including three from individuals, three from State agencies and organizations, and three from national agencies and organizations. Six of the nine respondents took the opportunity to comment on the reintroductions; there were three who supported the reintroductions and three who did not. The three responses supporting the reintroductions were from two individuals and one national organization. The three responses not supporting the reintroductions were from one State agency (North Carolina Department of Agriculture), one State organization (North Carolina Farm Bureau Federation), and one individual.

Comments received are presented below as a series of issues, with each being followed by the Service's response.

Issue 1: The North Carolina Department of Agriculture and the North Carolina Farm Bureau Federation specifically addressed their nonsupport with regard to the expansion of the Alligator River reintroduction to Pocosin Lakes. Also, the one individual voicing nonsupport was located in the expansion area.

Service Response: Pocosin Lakes did not exist in 1986 when regulations were finalized for the reintroduction of red wolves at Alligator River. The final rule stated that the project would be reevaluated after 5 years and such reevaluation would include public meetings. The result of the reevaluation, which included public meetings, was to expand the reintroduction project to Pocosin Lakes. This was a logical decision based on the success of the reintroduction to that point in time, the establishment of Pocosin Lakes as one of our national wildlife refuges which are mandated to conserve and recover endangered species, and the location of Pocosin Lakes within the existing experimental population boundaries established in the final rule of November 19, 1986 (51 FR 41790). The reintroductions per se have previously been through the rulemaking process and are outside the scope of this revision to the existing rule.

Issue 2: One individual was opposed, in general, to classifying endangered animals as nonessential experimental and, within this designation, relaxing protection for them. This individual favored more, not less, protection and wondered why the provisions would be extended to animals outside the experimental population areas and if the provisions would apply in the future to the island propagation sites.

Service Response: The provisions for classifying listed species as nonessential experimental were provided by 1982 amendments to the Act. These provisions were designed to resolve the dilemma of significant local opposition to translocation efforts due to concerns over the rigid protection and prohibitions surrounding listed species under the Act. The resolution was to provide new administrative flexibility for selectively applying the prohibitions of the Act to experimental populations. Final regulations establishing procedures for designation of experimental populations, determination of such populations as ''essential'' or ''nonessential,'' and promulgation of appropriate protective regulatory measures were published in the Federal Register on August 27, 1984 (49 FR 33885). These provisions were necessary to obtain public support for attempts to reintroduce red wolves and were, therefore, an essential ingredient in success at reestablishment of the species. Prior to these provisions, attempts to reintroduce red wolves and other endangered species, particularly predators, were routinely unsuccessful because of local opposition.

The reasons for extending the provisions of this rule to animals outside the experimental population boundaries are believed to be adequately explained in the Background section of this rule. These provisions do not apply to the island propagation projects, and the Service has no intention of declaring these animals nonessential experimental in the future.

Issue 3: Responses from the North Carolina Wildlife Resources Commission (Commission), North Carolina Department of Agriculture (Department), and North Carolina Farm Bureau Federation (Federation) addressed the reporting requirements. The Department and Federation believe that livestock owners should be allowed to take red wolves engaged in depredation without notifying the Service and awaiting recapture attempts. At the other extreme, the Humane Society of the United States (Society) wants no provision for private citizens to take red wolves for any purpose. The Commission recommended that ''immediately'' be defined as 5 business days, and the Commission and Federation recommended that ''immediately'' be deleted from the provision for taking outside the designated experimental population area. The Commission also pointed out that local residents are more familiar with and are more likely to call the local State wildlife enforcement officer through an available toll free number.

Service Response: The Service agrees to delete the word ''immediately'' from the provision for taking outside of the designated experimental population area because the intent was to delete reporting requirements altogether. In addition, the term ''immediately'' has been replaced by ''within 24 hours'' for areas within the experimental population areas. It is important to report taking and harassment incidents quickly so that Service personnel can respond right away in order to minimize conflicts and retrieve any carcasses for necropsy before such carcasses deteriorate to the degree that necropsy results are compromised. Five days, as recommended by the Commission, would not allow such a quick response. Telephone access is such that reporting incidents within 24 hours should pose no burden on the public.

Changes are made to allow private landowners to take wolves that are in the act of killing livestock or pets prior to reporting such incidents to the Service.

The Service contacted the Tennessee Wildlife Resources Agency to obtain approval to also list the local State wildlife enforcement officer in that State as a contact for meeting the reporting requirements. Such approval was received, and this change, as recommended by the Commission, has been made. The State enforcement officer will, in turn, notify the Park superintendent or refuge manager so that Service personnel can respond to such incidents.

Issue 4: The Commission, Society, Federation, and American Sheep Industry Association (Association) commented on the incidental taking provision. The Federation supported the inclusion of lawful activities, other than recreational, in the provision. The Commission recommended that ''incidental'' be defined as ''unavoidable, unintentional, *or* not resulting from negligent conduct, taking reasonable due care'' in order to prevent the prosecution of well-intentioned citizens who may kill a red wolf, believing it to be a coyote. The Society, on the other hand, believes that the broad definition will invite abuse. The Association was concerned about whether the provision would be applied to livestock owners outside the Park, as well as inside, and who would make the decision on negligent conduct.

Service Response: The Service found it necessary to change the language in this provision to clarify the intent and to remove any ambiguity. Experience during the past several years indicates that direct human-induced red wolf mortality is rare. The Service has therefore determined that it is appropriate to modify the language of the special rule to implement section 9 provisions for the red wolf by limiting the section 9 prohibition on private lands to cover intentional and willful taking only. Unlike the protection afforded all endangered and most threatened species, this provision will make the taking of a red wolf on private lands a specific intent crime. This provision will apply to all private landowners. The concept of a general intent violation (i.e. avoidable take or take through mistaken identity) that was present in the earlier rule is now used only on lands owned or managed by Federal, State, or local government agencies.

Issue 5: In addition to comments addressed under reporting requirements, the Association's comments indicated overall support for the provision but recommended that a maximum of 48 hours Service response time be included and that the biologist ''on site of the depredation'' give approval in a reasonable time period. The Commission recommended that approval be given within 5 days and that takings be reported to the Service project leader or biologist. The Federation also supported expanding the harassment provisions to private individuals around residences. However, the Department and the Federation felt that the take provisions did not go far enough in protecting the interests of livestock owners and thought that a time period should be specified for approval of livestock owners to ''take'' offending animals. As indicated in the comments on reporting requirements, the Society recommends that private citizens not be allowed to take red wolves for any reason and that other provisions in the rule are sufficient to protect private residences without allowing the taking of animals by private citizens. The Society also believes private citizens should have the responsibility to protect pets and private property from wildlife.

Service Response: The Service has revised the provision to allow private landowners to harass wolves in an opportunistic manner at any time on their property and to take such animals with Service approval if the Service's attempts to take the animals are unsuccessful. Notification would allow the Service to remove the offending animals, which are still valuable to the recovery objectives as breeding animals. If unsuccessful in removing the animals, the Service will permit the landowner to take action to remove any returning animals. The provision has also been revised to make it clear that the Service project leader or biologist on site of the depredation will provide approval to the private landowner and has indicated in the previous sections explaining the rule changes that such approval will be provided when the Service abandons attempts to capture the offending animal. A definite time period for such approval cannot be provided because of the variation in individual wolf behavior; e.g., one wolf may stay in the vicinity or return daily, while others may not return for days. The Service also adopts the 48-hour Service response time to reported incidents, as recommended and indicated in the previous sections explaining the rule changes. The Service project leader or biologist has been added as a contact for reporting any taking, although it was intended that reports to this individual would meet the provision as previously stated, because the Service project leader or biologist serves as the representative of the Park superintendent or refuge manager.

While the position of the Society regarding responsibility of private citizens to protect pets and property is reasonable with regard to naturally occurring wildlife species, programs to purposely reintroduce predators, such as the red wolf, must be accompanied by provisions to protect private property from the presence of such reintroduced animals if the landowner does not want them on his property. Such protection is necessary in order to obtain local public support, which is essential to success. Without such support, reintroductions are doomed, because the animals can be efficiently eliminated, as evidenced by past history.

Issue 6: The Federation did not understand the need to list the North Carolina counties as part of the historic range of the species and stated that it should be presented in the information section unless it is absolutely necessary to establish the nonessential experimental use population designation.

Service Response: The Service believes that it is helpful to establish experimental population boundaries for reintroduction efforts.

Issue 7: The Commission objected to the addition of any counties to the experimental population area because (1) it would increase the public's perception of ''government land-grabbing'' and (2) it is unnecessary since the provisions for red wolves within the designated experimental population area will also be applied to red wolves outside the designated experimental population area, except for reporting requirements.

The Association expressed concerns that as red wolves continue to disperse from ''core areas,'' the areas will increase in size and more private property will be brought under the experimental population designation. The Association also expressed concerns that the provision for allowing the ''take'' of red wolves under certain circumstances on property outside the buffer zone will eventually be removed.

Service Response: The proposed addition of Martin and Bertie Counties was to provide a buffer around the release area. Although red wolves would not be released in these counties, their proposed addition, for management purposes, was because of their close proximity. The Service would expend efforts within these counties to provide information on the project and would quickly respond and handle any problems caused by dispersing red wolves. Such rapid response would necessitate the reporting of such problems to the Service as soon as possible. Because the Service will be monitoring the animals and will be contacting individual landowners regarding the capture of dispersing animals, the more intensive broad-scale management within the counties may not be necessary. Therefore, the Service agrees to not designate additional counties for the experimental population area.

The Service has no intention of removing the ''take'' provisions on property outside the buffer zone. Reintroduced red wolves will continue to be managed as experimental populations until the recovery objective of 220 red wolves in the wild is met. At that time, the species would be delisted and managed as a resident species by the State.

National Environmental Policy Act

Environmental assessments were prepared under the authority of the National Environmental Policy Act of 1969 and are available for inspection by the public at the Service's Asheville Field Office (see **ADDRESSES** section). These assessments formed the basis for a decision that these actions are not major Federal actions which would significantly affect the quality of the human environment within the meaning of section 102(2)(C) of the National Environmental Policy Act (implemented at 40 CFR Parts 1500–1508). These minor rule changes do not require

revision of the environmental assessments.

Executive Order 12866, Paperwork Reduction Act, and Regulatory Flexibility Act

This rule has been reviewed under Executive Order 12866. The Fish and Wildlife Service has determined that the rule would not have a significant economic effect on a substantial number of small entities as described in the Regulatory Flexibility Act (Pub. L. 96–354). No private entities will be affected by this action. The rule does not contain any information collection or recordkeeping requirements as defined in the Paperwork Reduction Act of 1980 (Pub. L. 96–511).

Author

The principal author of this final rule is V. Gary Henry (see **ADDRESSES** section).

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Regulation Promulgation

Accordingly, part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations is amended as set forth below:

PART 17—[AMENDED]

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 16 U.S.C. 1531–1544, 16 U.S.C. 4201–4245; Pub. L. 99–625, 100 Stat. 3500; unless otherwise noted.

2. Amend § 17.11(h) by revising the entries for red wolf to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
MAMMALS:							
*	*	*	*	*	*		*
Wolf, red	*Canis rufus*	U.S.A. (SE U.S.A., west to central TX).	Entire, except where listed as Experimental Populations below	E	1, 248, 449, 579	NA	NA
do	do	do	U.S.A. (portions of NC and TN—see § 17.84(c)(9))	XN	248, 449, 579	NA	17.84(C)
*	*	*	*	*	*		*

3. Section 17.84 is amended by revising paragraphs (c)(4), (c)(9)(i) and (c)(10) of the section to read as follows:

§ 17.84 Special rules—vertebrates.

* * * * *

(c) * * *

(4)(i) Any person may take red wolves found on private land in the areas defined in paragraphs (c)(9) (i) and (ii) of this section, *Provided* that such taking is not intentional or willful, or is in defense of that person's own life or the lives of others; and that such taking is reported within 24 hours to the refuge manager (for the red wolf population defined in paragraph (c)(9)(i) of this section), the Park superintendent (for the red wolf population defined in paragraph (c)(9)(ii) of this section), or the State wildlife enforcement officer for investigation.

(ii) Any person may take red wolves found on lands owned or managed by Federal, State, or local government agencies in the areas defined in paragraphs (c)(9) (i) and (ii) of this section, *Provided* that such taking is incidental to lawful activities, is unavoidable, unintentional, and not exhibiting a lack of reasonable due care, or is in defense of that person's own life or the lives of others, and that such taking is reported within 24 hours to the refuge manager (for the red wolf population defined in paragraph (c)(9)(i) of this section), the Park superintendent (for the red wolf population defined in paragraph (c)(9)(ii) of this section), or the State wildlife enforcement officer for investigation.

(iii) Any private landowner, or any other individual having his or her permission, may take red wolves found on his or her property in the areas defined in paragraphs (c)(9) (i) and (ii) of this section when the wolves are in the act of killing livestock or pets, *Provided* that freshly wounded or killed livestock or pets are evident and that all such taking shall be reported within 24 hours to the refuge manager (for the red wolf population defined in paragraph (c)(9)(i) of this section), the Park superintendent (for the red wolf population defined in paragraph (c)(9)(ii) of this section), or the State wildlife enforcement officer for investigation.

(iv) Any private landowner, or any other individual having his or her permission, may harass red wolves found on his or her property in the areas defined in paragraphs (c)(9) (i) and (ii) of this section, *Provided* that all such harassment is by methods that are not lethal or physically injurious to the red wolf and is reported within 24 hours to the refuge manager (for the red wolf population defined in paragraph (c)(9)(i) of this section), the Park superintendent (for the red wolf population defined in paragraph (c)(9)(ii) of this section), or the State wildlife enforcement officer, as noted in paragraph (c)(6) of this section for investigation.

(v) Any private landowner may take red wolves found on his or her property in the areas defined in paragraphs (c)(9) (i) and (ii) of this section after efforts by project personnel to capture such animals have been abandoned, *Provided* that the Service project leader or biologist has approved such actions in writing and all such taking shall be reported within 24 hours to the Service project leader or biologist, the refuge manager (for the red wolf population defined in paragraph (c)(9)(i) of this section), the Park superintendent (for the red wolf population defined in paragraph (c)(9)(ii) of this section), or the State wildlife enforcement officer for investigation.

(vi) The provisions of paragraphs (4) (i) through (v) of this section apply to red wolves found in areas outside the areas defined in paragraphs (c)(9) (i) and (ii) of this section, with the exception that reporting of taking or harassment to the refuge manager, Park superintendent, or State wildlife enforcement officer, while encouraged, is not required.

* * * * *

(9)(i) The Alligator River reintroduction site is within the historic range of the species in North Carolina, in Dare, Hyde, Tyrrell, and Washington Counties; because of its proximity and potential conservation value, Beaufort County is also included in the experimental population designation.

* * * * *

(10) The reintroduced populations will be monitored closely for the duration of the project, generally using radio telemetry as appropriate. All animals released or captured will be vaccinated against diseases prevalent in canids prior to release. Any animal that is determined to be in need of special care or that moves onto lands where the landowner requests their removal will be recaptured, if possible, by Service and/or Park Service and/or designated State wildlife agency personnel and will be given appropriate care. Such animals will be released back into the wild as soon as possible, unless physical or behavioral problems make it necessary to return the animals to a captive-breeding facility.

* * * * *

Dated: December 27, 1994

Mollie H. Beattie,

Director, Fish and Wildlife Service.

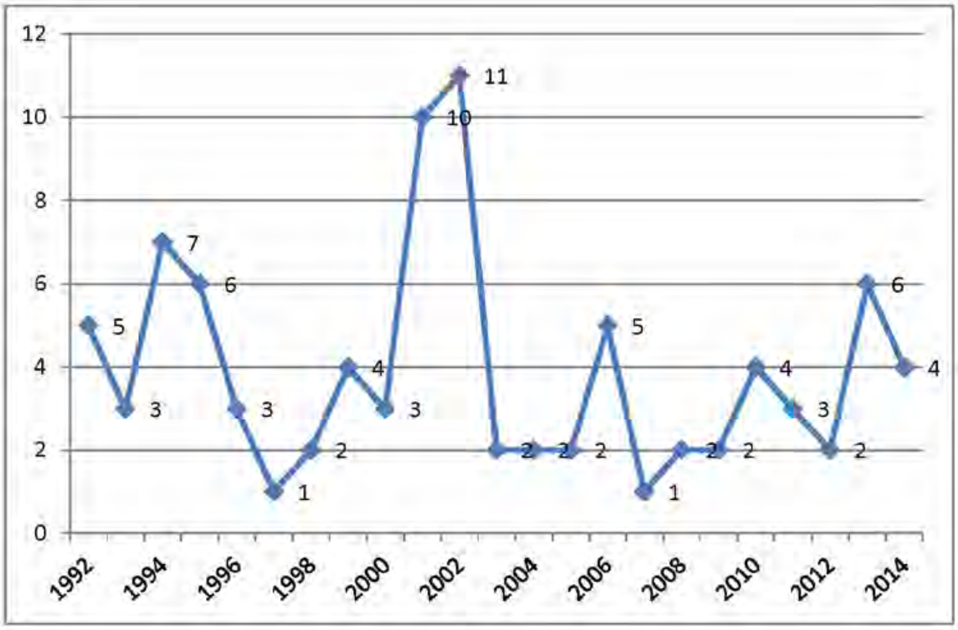
[FR Doc. 95–9291 Filed 4–12–95; 8:45 am]

BILLING CODE 4310–55–P

Summary of July 15, 2014 meeting with owners of Mattamuskeet Ventures LLC

Present: Jamin Simmons
Hoyt Lowder
Toliver Parks
Hunter Parks
Shelley Basnight
Bill Blount
Claude Long
Art Beyer (USFWS, Red Wolf Recovery Program)
Becky Harrison (USFWS, Red Wolf Recovery Program)

Population Trends on Ventures:



These numbers represent a snapshot on January 1 of each year of how many radio-collared red wolves were monitored on the property at that time. These totals will fluctuate throughout the year as pups are born, yearlings or younger adults disperse, and pups from previous seasons are caught and fitted with their initial radio collars. Pups are typically born in April or May. Through trapping efforts in the late fall and winter, Red Wolf Recovery Program (RWRP) personnel track and capture individuals, assess their condition, and determine if they have reached full size and can be safely fitted for a radio-collar.

Social structure:

Similar to other *Canis* spp., red wolves form monogamous breeding pairs. This pair bond is instrumental in behavioral strategies focused on maintained territories (Shaw 1975, Nowak et al. 1995, Paradiso and Nowak 1972). A resident pack then consists of the breeding pair and pups that are born and remain until dispersal. Within the Red Wolf Recovery Area (Recovery Area), USFWS biologists have observed territory sizes range from 8,000 – 40,000 acres, with a likely average of 10-15,000. The variation on size depends on factors including pack size, habitat quality, and prey and resource availability.

Current pack demographics on Ventures:

On January 1, 2014 we were monitoring 4 radio-collared adult red wolves: the breeding pair and 2 offspring born in 2012. In late January, 6 more individuals were caught, collared, and released with the assistance of Matthew Eakes. These animals included 5 pups born in 2013 and one juvenile that was born in 2012. Since then, one of the 2014 pups was killed in a vehicle collision, and two of the yearlings have begun dispersal movements. As a result, currently the breeding pair and 5 radio-collared animals are being monitored regularly. Given that reproduction has been successful in recent years, we anticipate many of these animals will disperse into neighboring territories in the upcoming seasons.

Diet studies:

The co-owners inquired about red wolf diets. Scat surveys have found that red wolves consume white-tailed deer, raccoons, rabbits, rodents (both nutria and smaller rodents), domestic and feral hogs, other mammals, and insects (Dellinger et al. 2011, McVey et al. 2013). McVey et al. (2013) compared diets of both red wolves and coyotes from 228 scats using genotyping procedures. The most common diet items found for both species were white-tailed deer, rabbits, and rodents. Hinton et al. (in review, but see Hinton 2014) also evaluated diets of red wolf packs, coyote pairs, and mixed pairs (a red wolf and a sterilized coyote). From 2009-2011, they collected and analyzed 1754 scats from 13 red wolf packs, 17 coyote pairs, and 8 mixed pairs. Red wolf packs consumed more fur bearers and pig than coyote pairs or mixed pairs. Bird items in all these studies (turkey or quail) were rarely found either through stomach content analysis or scat surveys. Egg shells and feathers could potentially show up in scats, but these were not frequently reported (McVey et al. 2013, Hinton 2014). To date we have not observed any adverse effects from red wolves on game population numbers. It should be noted that were game populations negatively impacted by resident canids, control measure are more successful with regards to wolves than coyotes (see Coyote Distribution and Control below).

Depredation issues:

Regarding depredations, data from USFWS public information that was specific to the program that existed in the Great Smoky Mountains National Park is being used to suggest excessive livestock/pet losses to wolves within the northeastern North Carolina (NC). Statements include the loss of over 20 calves and over 40 goats—these figures do not accurately represent incidents in NC. Of the 78

complaints we have received in northeastern NC regarding a wolf depredation on livestock or pets, upon investigation, in only 35 of these the depredation were we able to verify that a depredation took place. We respond to every complaint through various mechanisms including discussions with landowners, site visits and visual surveys, track surveys, camera trapping, traplines, and telemetry work.

- Of these 35, we found dogs, often the owners or neighbor's dog, to be responsible for the depredation.
- 10 were attributed to fox or bobcat
- 2 were attributed to coyote
- 1 was attributed to bear
- 6 depredations were found to involve red wolves

Details of the 6 wolf depredations:

1. July 1991: a captive released pair of wolves near Engelhard, Hyde County, was killing cats along a state rd. Both wolves were captured by program staff and returned to captivity indefinitely.
2. December 1993: a deer hound was killed by a pair of wolves on the Alligator River NWR. The hunter was compensated for the dog. Both wolves died from apparent old age within the year.
3. April 1997: An 8-year old male wolf was killed some neonate goats that wandered out of an open paddock onto state park lands in Washington Co. Trapping attempts by program staff were unsuccessful, so the wolf was removed by gunshot by program staff. The owner was compensated for the goat losses.
4. October 1998: An incapacitated sow hog was left outside at a hog barn in Tyrrell Co, pending disposal the following day and was killed by wolves that evening. As the hog was being disposed of, and the manager did not see a threat to the rest of the hogs, no action was requested.
5. July 2007: 8-9 goats were killed at or near a paddock Tyrrell Co. Some of the goats and left the paddock as it was open on one end and had moved into an adjacent block of timber also used by a wolf pack. One male coyote was captured on a trail going into the paddock and was euthanized. One wolf was captured in the timber and released well to the east. This wolf was carefully monitored with plans to remove indefinitely should it return near the goat paddock. No further losses took place.
6. July 2007: In response to chicken depredations in East Lake, Dare Co, across from ARNWR, there was evidence of wolf depredating. Aerial telemetry confirmed the presence of a breeding male in the area. Traps were set on site by program staff, but the wolf was shot shortly afterward by the owner while it was in the yard chasing chickens. No further action taken.

In addition to these complaints, 4 wolves were shot by landowners in the following circumstances:

1. 1995: A male wolf was shot in a yard while digging at a dog pen.
2. 2007: A male wolf was shot while walking towards a woman and her dog.
3. 2011: A female wolf was shot in a yard while chasing a dog.
4. 2013: A male wolf was shot after the discovery of missing chickens. The wolf was reportedly chasing a sheep at the time.

Coyote Distribution and Control:

While wolves were rather easily exterminated from the US during the predator control efforts of the early 20th century, the range of the coyote increased. Despite widespread efforts to suppress coyote populations within their historical range, coyotes have quickly colonized most of North America (Nowak 2002). During the initial site selection process for the red wolf re-introduction program, the Recovery Area was considered uninhabited by coyotes. However, coyotes have expanded their historical range eastward; individuals were observed in the area beginning in the early-1990s. Decades of effort have been spent trying to remove coyotes to protect domestic livestock from predation (mostly in the western US). However, efforts to remove the offending individuals are often problematic and produce inconsistent results (Conner et al. 1998, 2008).

We are not currently monitoring any radio-collared coyotes on Ventures. Consequently, we do not have an accurate estimate of how many coyotes use the property. We suspect transient coyotes may investigate different areas in/around the property periodically and be present as they pass through different parts of the landscape. More generally, it is estimated that within the 5-county Recovery Area, coyotes outnumber red wolves at least 3 to 1 (M. Chamberlain, personal communication) based on our trapping efforts and discussions with private trappers. The presence of a red wolf breeding pair and/or associated pack is typically sufficient to defend a territory from coyotes. Interspecific competition does occur in the Recovery Area and can result in red wolves displacing coyotes from a given area, or in some cases, results in the death of a coyote.

Using sterilized placeholders to deter interbreeding between red wolves and coyotes
Because coyotes are territorial and typically kill livestock to provision their pups, researchers began testing whether surgically-sterilized but hormonally-intact coyotes could function to protect livestock by defending space against coyotes needing to provision pups (Bromley and Gese 2001a, 2001b, Seidler and Gese 2012). It is this concept of holding space that is being applied to manage hybridization between red wolves and coyotes by providing managers time, information, and a higher degree of control over the recovery landscape, while simultaneously providing reproductive advantage to the red wolf. More recently, there has also been additional research examining whether sterilizing coyotes would similarly change coyote predation rates on pronghorn antelope fawns (Seidler et al. 2014). These researchers found that survival rates of pronghorn fawns captured in sterile coyote territories were 242% higher as compared to fawns captured in intact reproductive coyote territories.

Interbreeding between red wolves and coyotes produces hybrid offspring resulting in coyote gene introgression into the wild red wolf population, which threatens recovery goals. During denning season, we test all observed litters to determine genetics. Hybrid litters are destroyed. Under the current genetic tests used to analyze canids, a hybrid contains up to 87.5% red wolf ancestry. This could also include what we call a coyote backcross that may contain a very small amount of wolf integration but phenotypically may similar in size to a coyote. In a small number of cases we have sterilized these smaller hybrids to temporarily hold specific territories.

An adaptive management plan (Kelly et al. 1999; Rabon et al. 2013) was developed by the U.S. Fish and Wildlife Service to reduce interbreeding and introgression while simultaneously building the red wolf population. It effectively uses techniques to capture and sterilize hormonally intact coyotes via vasectomy or tubal ligation procedures performed by a local veterinarian, and then releases the sterile coyote at its place of capture to act as a territorial "placeholder" until the animal is replaced by dispersing red wolves. Sterile coyotes are not capable of breeding, effectively limiting the growth of the local coyote population, while also reducing hybridization with red wolves. A sterile placeholder coyote also will exclude other coyotes from its territory. Ultimately, the placeholder coyotes are replaced by the larger red wolves either naturally or via management actions (e.g., removal of the coyote followed by insertion of wild or translocated wolves). In addition to the radio-collared red wolves, we regularly monitored the sterilized, radio-collared placeholders.

We have been sterilizing coyotes since 1999, and have witnessed numerous events (>35) in which red wolves displace sterilized animals. Additionally, we have observed 15 incidents in which red wolves were responsible for the death of sterilized placeholders. (Note: there may be additional events, but we can only track sterilized animals since they are radio-collared). We have no evidence of a coyote successfully displacing or killing a red wolf from its territory. As the red wolf population grows, having space available for dispersing red wolves will become increasingly important, and this space will be provided through natural interspecific competition and/or management actions. Ideally, red wolf pairs would hold all possible territories in the Recovery Area, but with sustained losses (due to an increasing occurrence of gunshot-related deaths in recent years); using sterilized coyotes can plug some of these lost wolf territories as we discussed.

Bottom line: Why are red wolves important?

1. **Biological benefits**
   Red wolves were native to this area and a natural part of these ecosystems. The removal of a top predator could result in the disruption of various ecological processes. By controlling nest predators (e.g., raccoons), red wolves can indirectly affect some ground nesting bird species including quail and wild turkey. Red wolves may contribute to some control of nuisance or invasive species. It is well documented that both feral pigs and nutria are items in their diets. The red wolf is also an umbrella species. Ecosystems which support and conserved red wolves are likely to maintain a diversity of other wildlife and plants.
2. **Economic benefits**
   Past economic studies (Cheatum and Ogg, 2012, Lash and Black 2005) show the red wolf can attract millions of dollars to local economies via ecotourism. The Lash and Black study in particular measured good potential to further enhance economic contributions across the Albemarle Peninsula and in the Inner Banks region, based on red wolf ecotourism. Recreation in this region is undoubtedly a big business. In a 2006 report to the NC Wildlife Resources Commission (available online at http://www.ncwildlife.org/portals/0/Hunting/Documents/2006NCEconomicImpacts.pdf), estimated retail sales related to all hunting activities was more than $511,000/year. Retail sales generated from all wildlife watching activities were more than $916,000/year. There

are some more recently generated summaries also available from 2011 (http://www.fws.gov/southeast/northcarolina/economicimpact-nc.html). These results similarly demonstrate the importance of sportsmen to North Carolina's economy.

3. **Cultural and ethical benefits**

   These beliefs are clearly more personal and subjective, but from reports we receive, many people enjoy seeing the wolves and appreciate the opportunity to be outdoors and recreate in an environment where the full natural diversity of wildlife exists. The Recovery Area in northeastern NC is currently the only wild red population. Humans played a large role in facilitating the extermination of this species throughout its historic range. As a result, some people believe we are ethically responsible to conserve red wolves and other imperiled species and assist recovery efforts.

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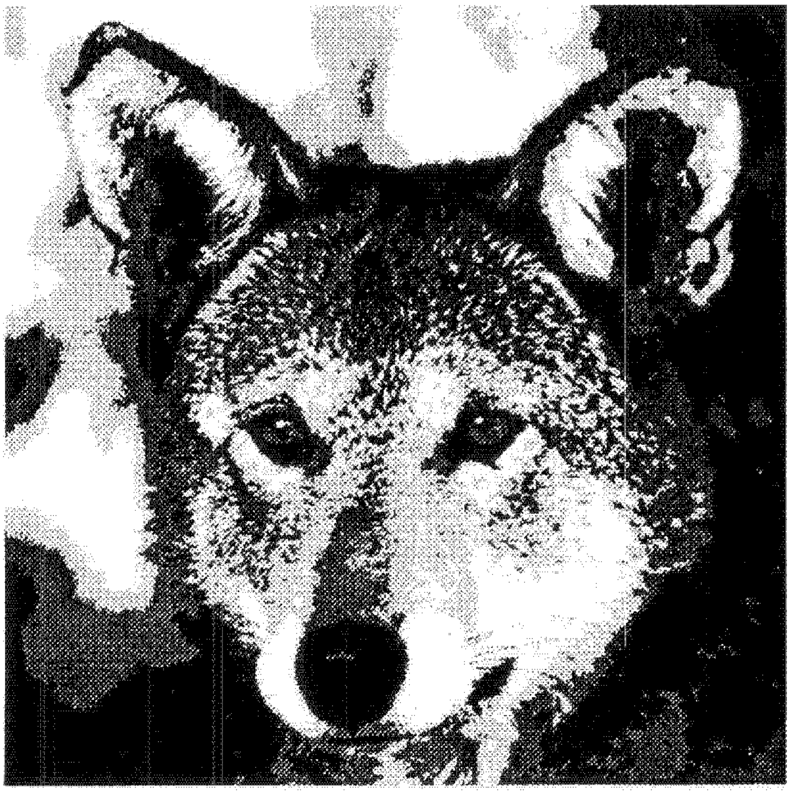
Red Wolf

Recovery/Species Survival Plan



Canis rufus

U.S. Fish and Wildlife Service

RED WOLF RECOVERY PLAN

(Original Approved: July 12, 1982)

Prepared by:

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for
Southeast Region
U.S. Fish and Wildlife Service
Atlanta, Georgia

October 1990

Approved: ____________________

Date: October 26, 1990

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect the species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 1989. Red Wolf Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, GA. 110 pp.

Additional copies of this plan may be purchased from:

Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814
Phone: 301/492-6403 or
1-800/582-3421

The fee for a plan varies depending on the number of pages in the plan.

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EXECUTIVE SUMMARY FOR THE RED WOLF RECOVERY PLAN

Current Status: This species is listed as endangered. Although thought to be extinct in the wild by 1980, recent recovery efforts have placed small numbers of red wolves at four locations within the species' historic range. One is a major reintroduction site in northeastern North Carolina, and the other three are island propagation projects. At the present time there are 135 red wolves in existence--115 in various captive facilities and 20 in the wild.

Habitat Requirements and Limiting Factors: Large areas of habitat of at least 170,000 acres in size are required by this species, preferably dedicated units of National Wildlife Refuge lands and National Park Service properties. The absence of coyotes is preferable, but low to moderate populations of these competitors should not exclude an area from consideration. Human attitudes regarding wolves are probably the most significant single factor involved in recovery planning for these animals.

Recovery Objective: The establishment of 220 red wolves in wild situations and the maintenance of 330 in captivity would provide for genetic stability and maintain the species. For the foreseeable future it is not considered feasible to either delist or downlist this species.

Recovery Criteria: Establish and maintain at least three reintroduction projects within the historic range of the red wolf. This must be paralleled by the cooperation and assistance of at least 30 captive-breeding facilities in the United States. Human attitudes regarding red wolves must be addressed through education processes.

Actions Needed:

1. Maintain and evaluate existing wild populations.
2. Establish new populations in the wild.
3. Expand captive-breeding capabilities.
4. Expand cryopreservation capabilities.

Costs ($000's):

Year	Need 1	Need 2	Need 3	Need 4	Total
1990	195.0	50.0	188.0	12.0	445.0
1991	225.0	230.0	208.0	10.5	673.5
1992	368.5	300.0	260.0	20.0	948.5
1993	400.0	250.0	200.0	20.0	870.0
1994	500.0	150.0	200.0	10.0	860.0
1995	500.0	100.0	100.0	10.0	710.0

Date of Recovery: A reassessment of the red wolf recovery program should be made in 1995, and more realistic projections should be formulated then.

PREFACE

The red wolf (*Canis rufus*) was one of the first endangered species to attract recovery attention by the U.S. Fish and Wildlife Service (Service) after the passage of the Endangered Species Act on December 28, 1973. An interim recovery team was appointed on August 4, 1974, and in January 1975, it received official sanction by the Service.

By mid-1975 it became apparent that the only way the red wolf could be saved from extinction was to capture as many wild animals as possible and place them in a secured captive-breeding program.

In July 1982, a Red Wolf Recovery Plan was approved by the Director of the Service. This plan was revised, updated, and approved on September 18, 1984. The original recovery team was disbanded, and a new team was appointed by the Southeast Regional Director of the Service in 1986.

A major step toward recovery for the species has been the apparently successful reintroduction of wolves at the Alligator River National Wildlife Refuge in 1987. Some of these captive-born-and-raised animals are adjusting to a wild environment and have reproduced in the wild. Considerable public interest in the plight of the red wolf and reintroduction attempts has developed.

In May 1988, Service officials met with genetic and demographic specialists in Apple Valley, Minnesota, to develop population goals for the red wolf. Because captive breeding has played such a decisive role in the survival of the species, it was determined that a completely revised Red Wolf Recovery Plan should be integrated into a Species Survival Plan (SSP). A Species Survival Plan is the zoological community's plan for addressing biological and organizational questions regarding long-term propagation of an endangered species. Species survival planning is done under the auspices of the American Association of Zoological Parks and Aquariums (AAZPA).

This combined plan is therefore intended to serve as a guide that delineates and schedules actions believed necessary to restore the red wolf as a component of certain ecosystems within the Southeastern United States. It is a multifaceted plan, incorporating captive-breeding objectives as well as reintroduction and propagation-in-the-wild strategies.

Red wolf reintroductions into the wild will entail coordinated and cooperative efforts from many local, State, and Federal entities and national environmental organizations, as well as the cooperation of private and corporate landowners in many areas of the Southeast.

Complete species recovery permitting delisting will probably never be achieved for the red wolf. It is realistic, however, to restore carefully managed disjunct populations within portions of its

historic range and to secure the genetic integrity of the species. Addressing 1988 recovery amendments to the Endangered Species Act becomes difficult in light of specific obstacles that will surely frustrate red wolf recovery objectives. Defining those monetary and time requirements that would be represented as achieving delisting depends to a great extent on the success of a current experimental release of red wolves into the Great Smoky Mountains National Park in western North Carolina and eastern Tennessee. If this study demonstrates that red wolves successfully compete with resident coyotes, then objectives as set forth in this plan can likely be achieved. If, however, it becomes evident that the two wild canids exhibit social interactions and interbreeding, then the fate of the red wolf will likely rest with island sanctuaries where the genetic integrity of Canis rufus can be maintained only through long-term management.

PART I

INTRODUCTION

The primary long-range goal of the Red Wolf Recovery Program has always been to reintroduce this extinct-in-the-wild species into portions of its historic range. The red wolf has been characterized by several writers as the "Flying Dutchman" of the wildlife world--a species without a safe haven since the early 1970s. This plan is prepared in an effort to bring forward the latest information available on the historical status of the species, the various factors that led to its ultimate demise in the wild, and the planning being made to recover this unique animal in portions of its historic range.

Historic Overview

The Genus Canis in North America

Taxonomists generally agree that there are three living species of wild *Canis* in North America--the coyote (*C. latrans*), the gray wolf (*C. lupus*), and the red wolf. The gray wolf is circumpolar in distribution and is represented by over 30 subspecies worldwide. This robust animal once occurred throughout North America, represented by 24 subspecies whose range extended from Southern Mexico northward to Greenland and Ellesmere Island (Hall and Kelson 1959). The coyote was originally found throughout most of the western half of North America, and in the last 40 years its range has been expanding eastward. The red wolf appears to be a species that, for a variety of factors, was adapted to the Southeastern United States.

Taxonomic Status of the Red Wolf

The canids of the Southeast have been assigned various scientific and common names, primarily by people who had not closely studied the animals. Bartram (1791) first described the red wolf in Florida, but writings dating back over 300 years mention wolves throughout the Southeastern United States, from central Texas to Florida and north to the Ohio River Valley. Audubon and Bachman, in their classic work (1851), were the first to suggest that in the southern states there existed a wolf that was structurally different from other wolves they had seen. They described the "Black American Wolf" as occurring only in Florida, South Carolina, North Carolina, Kentucky, southern Indiana, southern Missouri, Louisiana, and northern Texas. They also discussed the "Red Texan Wolf," which they thought ranged from northern Arkansas through Texas and into Mexico, but believed all the wolves they described were only varieties of one species.

Unfortunately, the red wolf was exterminated from most of its range by the early part of this century (Nowak 1972). Few specimens were

preserved, and there were no definitive descriptions of the animal's appearance or life history. Because of this, we know little of the animal under natural conditions. During the late 1800s and early 1900s significant revisions were initiated in the taxonomy of this unique wolf. Bangs (1898) determined that the Florida wolf should be elevated to full species level (*Canis ater*), while Bailey (1905) elevated Audubon and Bachman's "Red Texan Wolf" to a full species as *Canis rufus*. Bailey assigned this new species to a range in southern and central Texas. Vernon Bailey was the chief field naturalist of the U.S. Biological Survey (predecessor of the Service) and was the first knowledgeable biologist to examine the wild canids of Texas. He found the small red wolf of the south-central part of the State to differ so greatly from the larger gray wolf of the plains just to the west that the two deserved to be treated as completely different species. Miller (1912) designated the Florida wolf as *Canis floridanus*, which generally became accepted for all wolves in the forested areas of the Southeastern United States, while *C. rufus* continued to be recognized in central and southern Texas (Nowak 1979).

Years later, Edward A. Goldman (Goldman 1944), senior biologist with the U.S. Biological Survey, examined a larger number of canid specimens and found that the Texas red wolf intergraded in characteristics with the canids across the Southeastern United States to Florida, including a continuity of key cranial and dental features. Goldman thus consigned all of the wolves of the Southeast to one species, *C. rufus*. By the time of the publication of this revisionary work in 1944, the red wolf had already been extirpated east of the Mississippi River. Goldman listed *C. r. rufus* for the small Texas subspecies, *C. r. floridanus* for the eastern subspecies, and *C. r. gregoryi* in the lower Mississippi Valley. Goldman's nomenclature persists to the present time (see Plate 1).

Later investigators have generally supported Goldman's classification. An exception to this is Lawrence and Bossert (1967), at Harvard University, who performed a multiple character analysis of North American *Canis*. This study involved carefully measuring a series of skulls and subjecting the resulting figures to numerical analysis by computer. The skulls included those of 20 gray wolves, 20 coyotes, 20 domestic dogs (*C. familiaris*), and a small number of red wolves collected before 1920. The results of their study suggested that the red wolf was close enough to the gray wolf to be considered only a subspecies of the latter (Lawrence and Bossert 1967).

Paradiso (1968) and Nowak (1979) suggested that Lawrence and Bossert's sample size had been too small and did not truly represent the great geographic and individual variation of the canids. Paradiso and Nowak (1971) sampled a large number of skulls of *C. rufus*, *C. lupus*, and *C. latrans* and concluded that the red wolf was a distinct species.

Plate 1. Map showing localities of C. rufus from archeological sites (triangles), and fossil C. rufus (black dots). The solid lines show the distribution of subspecies: C. rufus rufus (R), C. rufus gregoryi (G), and C. rufus floridanus (F). Because of scale of map, it is not possible to plot all localities in crowded areas. (From NOWAK: 1979).

Later, Nowak (1979), in examining the systematic problems in the genus _Canis_ in North America, conducted multivariate analyses on approximately 5,000 canid skulls. His conclusions, as well as those of Kurten and Anderson (1980), agree in the probable derivation of the red wolf from a coyote/wolf ancestor and a later separation of the gray wolf, which entered (or reentered) North America at a later date. Nowak (1979) expressed his conclusion as follows:

> "In nearly all measurements and other features in which _C. rufus_ differs from _C. lupus_, the former approaches _C. latrans_. Indeed, available specimens of the red wolf almost bridge the morphological gap between the proximal extremes of the other two species. Hybrid origin for _C. rufus_ thus seems to be one possibility, but there are other solutions to the problem. The most reasonable explanation is that _C. rufus_ represents a primitive line of wolves that has undergone less change than _C. lupus_, and has retained more characters found in the ancestral stock from which both wolves and coyotes arose."

In later assessing these conclusions, Nowak (1989) reaffirms his position:

> "That last particular statement reflects one of the positions in my dissertation about which I feel most confident. The original characters of _C. rufus_ can be traced back long before hybridization would have begun, even into the Pleistocene. _C. rufus_ did not have a hybrid origin, but it does retain ancestral features, and thus it is morphologically shifted away from _C. lupus_ in the direction of _C. latrans_."

It is significant to note that Nowak (1989) continued his line of thought by commenting that his above-referenced conclusion:

> "...does not necessarily mean that _C. rufus_ is a distinct species. One could argue that, while _C. rufus_ is primitive, _C. lupus_ never became completely isolated from it genetically, and that the two were blending to some extent where their ranges met in North America. Unfortunately, there are very few specimens from appropriate times and places. My own samples showed so little overlap that I considered it best to treat the two as distinct species."

In a comparative gross morphological study of the cerebellum in six species of _Canis_, Atkins and Dillon (1971) confirmed the distinct speciation of _C. rufus_ and concluded that, while the red wolf is most closely related to _C. lupus_ in its cerebellar features, it appeared to be more primitive in several aspects than any of the other species of _Canis_ considered. A related study of canids from Missouri by Elder and Hayden (1977) demonstrated, by multivariate analysis of

skulls collected, a complete separation of coyote, dog, gray wolf, and red wolf. This investigation also revealed that during the 1940s and 1950s there was an infusion of red wolf genes into the coyote population as the red wolf was being exterminated in Missouri. This information reinforces conclusions reached later by Nowak (1979) and other researchers.

In a December 7, 1981, letter from Donald C. Morizot (1981), a researcher at the University of Texas System Cancer Center, to Service biologist Curtis J. Carley, Morizot set forth some of the findings of his biochemical-genetic study of the evolution of canid species. He stressed the fact that few biochemical-genetic differences among living Canis species have been discovered. Morizot's study (unpublished data), however, did detect "substantial genetic variation at three enzyme loci" in red blood cell samples in comparisons of dogs, coyotes, red wolves, and gray wolves. Samples of red wolf blood cells examined resulted in an allele not seen in any other Canis. He concluded that the red wolf is genetically more similar to the coyote than the gray wolf but possesses an allele unknown in coyotes. Additional data derived from skull measurements of red wolves and coyotes in early collections convinced him of the integrity of the red wolf as a separate form which should be recognized as a small wolf which evolved in North America.

After Lawrence and Bossert (1967) published their contention that the red wolf should be treated as a subspecies of the gray wolf, other investigators have supported their findings, including Mech (1970). It is interesting to note that the literature is not consistent in the ancestral relationship of C. rufus in the genus Canis, even among those investigators who support speciation. While Lawrence and Bossert (1967) and Atkins and Dillon (1971) differ on the question of speciation, both consider the red wolf to be closely allied to C. lupus. Conversely, both Nowak (1979) and Morizot (1981) support speciation but consider the red wolf to be more closely related to C. latrans.

At the time of this writing, efforts are underway to critically assess biochemical variations within the wild canids of the United States utilizing the latest techniques in analyzing blood chemistry and DNA. It will probably be several years before definitive information is available to either support or reject the issue of speciation based on these tests. It should be noted, however, that all factors, including morphological and others, will have to be weighed in making any determination of speciation. No one single test can be relied on in addressing this important concern. In the interim the words of Clutton-Brock (1989) serve to guide red wolf recovery efforts:

> "I very much hope that you will be successful in your efforts to conserve the red wolf, which (whether it is called a race of Canis lupus or a distinct species of wolf) is clearly a distinctive wild canid that is in severe

danger of extinction and whose demise would mean a severe loss of biological diversity within the dwindling groups of large carnivores."

The Service recognized the red wolf as a species in listing it as an endangered species in 1967 (32 FR 4001). Subsequent Federal Register notices regarding the red wolf include 1979 (44 FR 29571), 1980 (45 FR 33768-33781), and 1986 (51 FR 41790-41796).

Human Conflicts

When the first American settlers arrived in what are now the Southern Atlantic States, they typically brought with them a deeply rooted European fear and hatred for wolves. Many of these Old World attitudes were founded on an animal that may have been more aggressive than its North American counterpart. Whether more aggressive or not, these Old World fears centered on the wolf as being not only a menace to farm and flock, but also in league with the Devil. Greek and Roman literature relate that men became wolves. In the fifteenth century a council of theologians determined that werewolves did exist (Young 1944).

With these ingrained fears, it is little wonder that New World wolves were pursued with a vengeance, and indeed, by 1920 C. r. floridanus was extirpated in the Southern Atlantic States. The species, by this time, had also vanished from southeastern Kansas and central Oklahoma and from much of its former range in Texas. By the late 1930s it is thought that only two viable concentrations of red wolves existed. One was located in the Ozark/Ouachita Mountain region of Arkansas, eastern Oklahoma, and southern Missouri, and the other was in the still extensive river bottom forests and coastal regions of southern Louisiana and southeast Texas (Nowak 1972).

Demise of the Species

Man played the major role in the extinction of the eastern subspecies of red wolf, C. r. floridanus. Fear and a gross misunderstanding of the animal led to early bounties and indiscriminate killing. Secondary impacts by man included extensive land-clearing and drainage projects during the early 1900s. The advent of World War I, with resultant logging and mineral exploration and road development, opened up last vestiges of once remote habitat and probably was the final blow that eliminated C. r. floridanus. These developments probably had similar impacts on other large predators, including the Eastern cougar (Felis concolor cougar) (U.S. Fish and Wildlife Service 1981).

These conditions paralleled the decline of deer herds and other forest wildlife prey which could have affected red wolf populations. It is probably no coincidence that deer herds in the Southeast reached an all-time low around 1920 (Barick 1951)--a date that approximates the extinction of C. r. floridanus. With deer numbers

at all-time lows, wolves were probably forced into closer contact with man and agricultural lands which typically harbored small prey species such as rabbits. Free-ranging livestock undoubtedly attracted some wolves with resulting wolf-related losses. All of these factors contributed to intensified predator control efforts.

Beginning around 1920, enough forest habitat had been cut over in eastern Texas and Oklahoma to intensify an eastward surge by *C. latrans.* This adaptable species responded for reasons that go beyond changes in land use. It appears that for thousands of years *C. latrans* and *C. rufus* existed along a north-south line that roughly bisected Texas and Oklahoma. As predator control efforts became more efficient, the larger and more easily caught red wolf (Pimlott and Joslin 1968) was totally removed from extensive areas, while in other areas its social structure was destroyed. Into these vacated habitats moved *C. latrans* (Paradiso and Nowak 1971). Over the years the situation became more and more threatening for the red wolf, and the possibility that the species was in danger of extinction was finally noted by McCarley (1962).

Paradiso and Nowak (1971), in reviewing the circumstances that led to the decline of *C. r. rufus* and *C. r. gregoryi,* pointed out that red wolf museum specimens collected west of the Mississippi River after the 1930s were much smaller than those collected prior to the 1930s. These they describe as a "different kind of canid." This situation was especially prevalent in northeast Texas, southern Louisiana, and portions of Arkansas where significant morphological diversity of representative canids indicated hybridization between red wolves and coyotes. This did not appear to be true in Oklahoma and Missouri where *C. latrans* simply replaced *C. rufus* as a result of effective control efforts.

By 1972, the range of the red wolf was eroded to a small coastal unit that included parts of Liberty, Chambers, Jefferson, Brazoria, Galveston, and Harris Counties in southeastern Texas, and Cameron and Calcasieu Parishes in southwestern Louisiana (Riley and McBride 1972). Here the red wolf continued to be menaced by man and an ever-expanding coyote population that threatened to overwhelm the species unless dramatic actions were taken.

The Recovery Program

In anticipation of the passage of the Endangered Species Act, the Service established a formal recovery program for the red wolf in the fall of 1973. Responsibility for the program was assigned to the Texas office of the Service's Division of Animal Damage Control in San Antonio, Texas, with Curtis J. Carley the program project leader. A Red Wolf Recovery Program office was established in Beaumont, Texas, near the center of the remaining range of the species. With the field program for the red wolf already underway, the Endangered Species Act was passed on December 28, 1973.

The recovery program was established on the basis of information indicating that a pure population of red wolves still existed in southeast Texas and adjacent areas of Louisiana. However, field work soon demonstrated that a "hybrid coyote-wolf swarm" had formed, first in central Texas and then spreading eastward (Carley 1975). This extensive hybridization apparently occurred only in the east-central Texas portion of the species' historic range (Paradiso and Nowak 1971). Among the canids of the area, wolves appeared to be in the minority. As a consequence of this finding, the recovery program was redirected from an objective of local preservation to one of planned extirpation of the species in the wild. However, the decision to remove the last red wolves from the wild could only be justified through the development of a long-range objective to eventually return the species to areas of its historic range.

The early Red Wolf Recovery Program was multifaceted. Since approximately 98 percent of the final range of the species was in private ownership, the first priority of the program was to respond immediately to any and all canid damage complaints. This action gave the program access to canid populations on private lands, reduced human persecution of the species, and gained landowner cooperation. While responding to damage complaints, the program had to simultaneously develop methods for determining "pure" wolves and wolf-like hybrids, establish a captive-breeding/certification program, monitor and evaluate alleged red wolves already in the Nation's zoos, develop and disperse public information, and evaluate sites and procedures for reestablishment of the species in the wild.

After proposals from several zoo facilities were solicited, a captive-breeding/certification program was established on November 26, 1973, through a cooperative agreement between the Service and the Metropolitan Park Board of Tacoma, Washington. The program was to be administered by the Board's Point Defiance Zoological Park. Coordination of the effort was administered by the Fish and Wildlife Service's Beaumont, Texas, Field Office.

Pending development of procedures for appointing endangered species recovery teams under the new Endangered Species Act of 1973, the Southwest Regional Office of the Service established an Interim Red Wolf Recovery Team on August 4, 1974. Since a biological staff already was working with the species, the purpose of the team was to advise and administratively assist the program in accomplishing its objectives. Team members were selected, not so much for their biological knowledge, but for their knowledge of State and Federal agency processes, procedures, and resources. Russel W. Clapper, manager of the Service's Anahuac National Wildlife Refuge, was selected as the team leader. Serving with Clapper were George R. Abraham (Service), Joe Herring (Louisiana Department of Wildlife and Fisheries), and Floyd Potter (Texas Parks and Wildlife Department). A number of consultants were officially designated to advise the recovery team, and arrangements were made for the team to confer with anyone who might have special knowledge that would be helpful in

developing recommendations. The Interim Red Wolf Recovery Team held its first working meeting in October 1974. Subsequently, the interim team was officially appointed in January 1975.

Due to the urgency of implementing recovery actions for the species, contracted studies were limited to those that would contribute directly to the objective of recovery. Proposed research projects were carefully evaluated for their potential for providing immediate information that would significantly aid the program in meeting its objectives. Only four projects were approved as having immediate benefit to the species. These projects related to sonographic analysis of canine vocalizations as an aid in locating and censusing canids in the wild (McCarley and Carley 1978), electrophoretic and chromosomal analysis of canids to aid in identification of red wolves and wolf-like hybrids, development of techniques for x-raying skulls of live canids to compare them with skulls of known wolves from museum collections, and an evaluation of internal and external parasites found in canine populations within the red wolf range.

Simultaneously, the demise of the species through hybridization with the coyote was being documented. Due to the confusion of characteristics displayed by the hybrid-infested population, no one character could be used to identify true wolves. Therefore, a number of indicators were used to determine whether an animal was a wolf. Those indicators included skull x-rays, knowledge of other canids examined from the same area, and the following minimum morphological standards:

	Male	Female
Skull length	8.6 in. (215 mm)	8.4 in. (210 mm)
Zygomatic breadth	4.4 in. (110 mm)	4.4 in. (110 mm)
Weight	50 lb. (22.5 kg)	42 lb. (19 kg)
Total length	53 in. (1,346 mm)	51 in. (1,295 mm)
Hind foot length	9.0 in. (229 mm)	8.75 in. (222 mm)
Ear length	4.75 in. (120.6 mm)	4.50 in. (114.3 mm)
Shoulder height	27 in. (685.8 mm)	26.5 in. (673.1 mm)
Brain/Skull ratio	23	23.5

Canids determined to be possible wolves were placed in the breeding/certification program or, if all facilities were full, released with radio collars on public lands or where private landowners gave permission. Since releasing captured coyotes and/or hybrids would tend to alienate private landowners and would increase the work load of the recovery effort due to unavoidable recaptures of animals, all canids determined to not be wolves were euthanized and their skeletal remains and data cards preserved as documentation of the canine population that was examined through the program. When the field program was concluded, all acquired specimens and data were transferred to the U.S. National Museum, Washington, D.C., for preservation and future reference.

From the fall of 1973 to July 1980, over 400 wild canids were examined through the recovery program. Of that number, only 43 wild canids were admitted to the breeding/certification program as probable red wolves (Carley 1975; McCarley and Carley 1978; Carley, personal communication). Due to the complexities of hybridization, final proof of the genetic integrity of the animals was determined only through the captive-breeding process itself. Offspring born to the program were maintained for 1 year and examined quarterly for the purpose of confirming the initial identification of their parents. As a result, a number of early litters were determined to consist of hybrids, and they and one or both of their parents were removed from the program. In some cases the parents of hybrid litters had to be bred with other wolves to produce a second litter that would determine which of the parents of the original litter was the hybrid. Although more of the original 43 wild canids in the program may have been true red wolves, short life spans, limited breeding facilities, and unavoidable medical problems (such as an outbreak of parvovirus) resulted in only 15 of the animals' becoming the founding stock of the red wolves existing today. The remains of all canids in the breeding/certification program, including those produced in captivity, continue to be preserved at the University of Puget Sound, Tacoma, Washington.

In the fall of 1984 the red wolf captive-breeding program was accepted by the AAZPA for development of an SSP. This ensured the integrity of red wolf captive-breeding efforts and greatly enhanced the Service's responsibility to properly undertake a selective breeding program for the species. The main thrust of this effort is to ensure the genetic integrity of the red wolf under captive conditions.

The red wolf breeding program evolved into one of the most successful captive-restoration efforts in the United States. Under the direction of Roland Smith, the Point Defiance Zoo and Aquarium continues to provide leadership in a national effort to maximize red wolf captive-breeding and cryopreservation banking techniques.

In 1978, Russel W. Clapper resigned as team leader of the Red Wolf Recovery Team. The administrative responsibility for the recovery team was then transferred from the Southwest Regional Office to the Southeast Regional Office in Atlanta, Georgia, and David W. Peterson (Service) was appointed new team leader. Abraham and Herring remained on the recovery team; however, with the center of recovery actions moving to the Southeast, the Texas Parks and Wildlife Department withdrew from formal participation on the team. Mary Anne Young was appointed as a new team member representing the concerns of environmental organizations.

Reintroduction Efforts

With the species at least safeguarded in captivity, program emphasis shifted to a strategy of reintroduction. Due to a history of failure

in previous attempts to reintroduce gray wolves in various areas (Allen 1979, Weise et al. 1975, and Henshaw et al. 1979), initial thoughts centered on locating an area where an experimental reintroduction could be employed to test management and public information techniques. Bulls Island, a 5,000-acre (2,000-ha) component of the Cape Romain National Wildlife Refuge in South Carolina, was selected for such an experiment. A great deal of effort was expended in coordinating the project with local and State officials and securing necessary grass-roots support. A 50- x 50-foot (15- x 15-m) chain-link acclimation pen was constructed on the island, and on November 3, 1976, a pair of originally wild-caught adult red wolves was flown from Tacoma, Washington, to Charleston, South Carolina, carried by truck and boat to the refuge island, and placed in the pen. On December 13, 1976, they were released. The two animals wandered extensively, leaving Bulls Island and going to nearby Dewees and Capers Islands. After 9 days of freedom, the female left Capers Island and was recaptured on the mainland. The male was recaptured within hours on Bulls Island.

A second reintroduction experiment on Bulls Island began with the arrival of another pair of wild-caught adults in Charleston on July 5, 1977. This pair was kept in the acclimation pen for 6 months and fed island prey species, then released on January 5, 1978. The pair remained on Bulls Island and adjacent Capers Island for over 8 months. The decision to recapture them was consistent with the original objective of the experiment. It was concluded that both releases were successes and yielded valuable information for future reintroduction attempts.

For the next 2 years, the Red Wolf Recovery Team evaluated various sites for a possible mainland reintroduction project. Sites considered during that time included Everglades National Park and Big Cypress Swamp, Florida, and Ossabaw Island, Georgia. At a Red Wolf Recovery Team meeting in June 1978 at Savannah, Georgia, a Tennessee Valley Authority (TVA) representative invited the team to examine their Land Between The Lakes (LBL) area in west Kentucky and Tennessee for the purpose of evaluating it as a reintroduction site.

A field review of the LBL site was made by the team in July 1979, and a formal recommendation to initiate a red wolf reintroduction effort there was made to the Regional Director of the Service by the team leader. A series of meetings to brief the Kentucky and Tennessee State wildlife management agencies were held, and the Director of the Service, by letter of August 1, 1980, to TVA's Chairman of the Board of Directors, requested that TVA formally consider a red wolf reintroduction proposal at LBL.

In early 1980, Warren T. Parker, a wildlife biologist with the Service, was assigned the responsibility of overviewing the LBL reintroduction effort and locating other potential reintroduction sites. Over the next 3 years, a great deal of coordination and interagency work was accomplished. In July 1982, a Red Wolf Recovery

Plan was approved by the Service. Also, a formal proposal to reintroduce red wolves at LBL was published in October 1983 (Carley and Mechler 1983).

On September 25, 1983, the TVA Board approved the project, and on October 21, 1983, a formal news briefing was held at LBL. During the next 3 weeks, a great deal of media attention focused on the proposed wolf project at LBL. During the last week of November and the first 2 weeks of December 1983, three public meetings to review and discuss the proposal were held in Kentucky (Kentucky Lake State Park, Bowling Green, and Lexington), and four similar meetings were held in Tennessee (Paris, Dover, Clarksville, and Nashville).

Public sentiment was generally mixed in both States, and organized opposition from environmental, livestock, and hunting interests evolved into a major factor that politically doomed the proposal. Another major contributing factor was the reaction of hunters who feared that the presence of red wolves on LBL would result in injunctions and court actions by protectionist groups to stop hunting in the area. This view was reinforced by letters from Defenders of Wildlife and the Humane Society of the United States that voiced objections to the LBL reintroduction, based primarily on concerns that reintroduced red wolves would not have complete protection under the Endangered Species Act.

Based on these and other relevant points of contention, the Tennessee Wildlife Resources Agency unanimously rejected the LBL red wolf proposal at a public meeting on January 6, 1984. Shortly thereafter, the Kentucky Department of Fish and Wildlife Resources adopted a similar statement of opposition. The Service therefore withdrew the proposal.

In retrospect, the LBL proposal was technically carefully conceived. It now appears, however, that not enough time was allocated to working with local officials and the public. More time should have been directed to those interests that later surfaced in organized opposition to the reintroduction of <u>any</u> predator. The spread of the coyote into the LBL area during the early 1980s also complicated the process and raised serious biological questions about potential interbreeding. Also, administrative and decision-making processes involved in dealing with four cooperating agencies (TVA, the Service, and the wildlife agencies of Kentucky and Tennessee) made quick resolution of any problem more difficult. A great deal was learned from the LBL project, and these hard-taught lessons were soon to be applied in eastern North Carolina.

<u>Reintroduction at Alligator River National Wildlife Refuge, North Carolina</u>

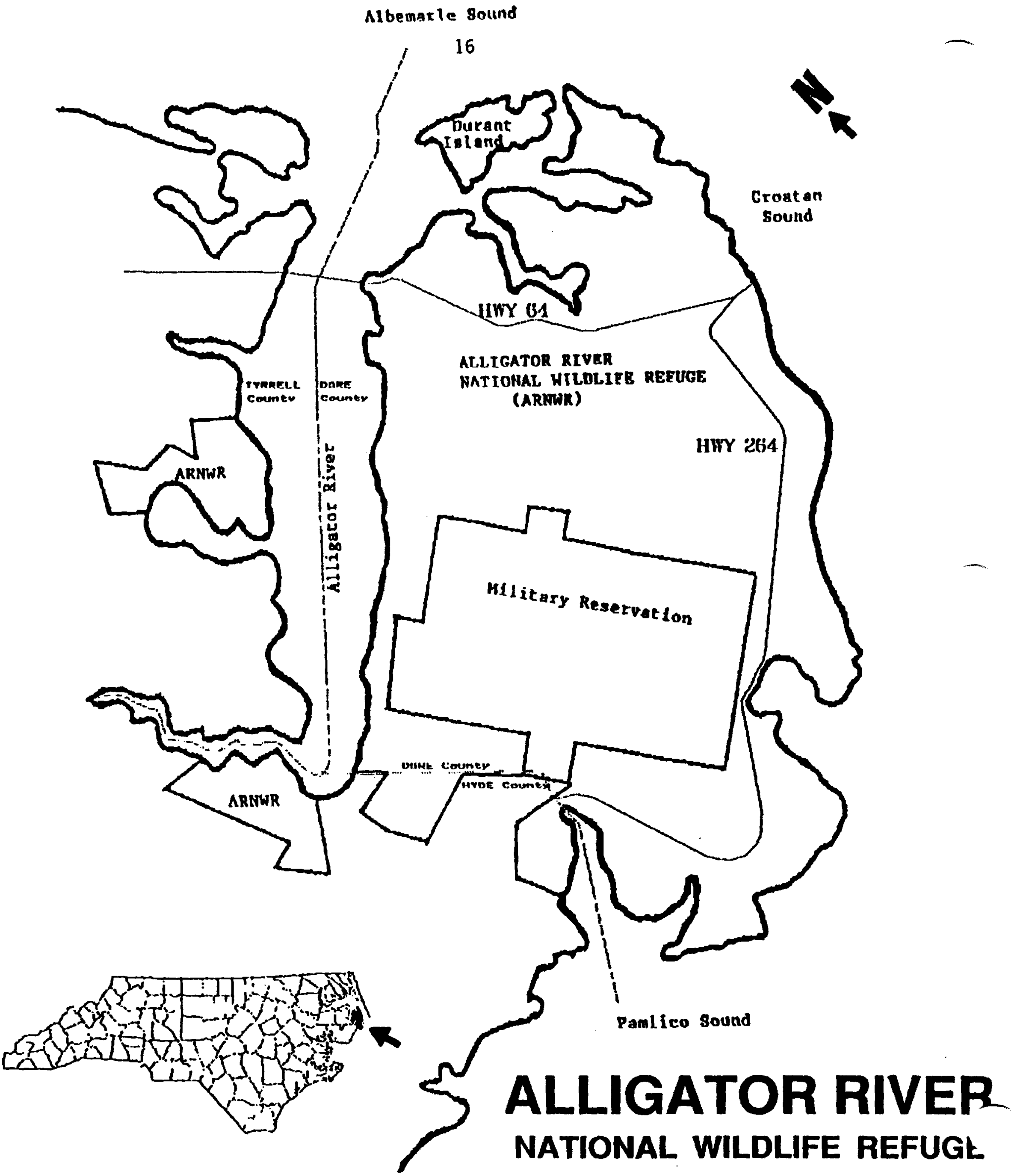
In March 1984, the Prudential Insurance Company donated to the Service nearly 120,000 acres (48,000 ha) of freshwater nonriverine swamp, pocosin, and brackish marsh habitat in Dare and Tyrrell

Counties, North Carolina. These lands were later to become the Alligator River National Wildlife Refuge (Plate 2). Field studies conducted by the North Carolina Biological Survey (NCBS) (Potter 1982), and later work jointly done by NCBS and Service personnel, indicated that the refuge harbored a moderate to good small mammal population. In addition, intensive surveys indicated an absence of coyotes and feral dogs. There was no livestock in the county, and the mainland portion of the county was sparsely populated.

A decision was therefore made to attempt to reestablish red wolves on the new refuge, after which a great deal of time was devoted to developing a favorable public climate for such a project. A major effort to more fully involve national environmental organizations included a briefing in Washington, D.C. A detailed reintroduction proposal was developed (Parker 1987a), and the North Carolina Congressional delegation was thoroughly briefed, as was the North Carolina Wildlife Resources Commission, the Commissioner of Agriculture, and the Governor's staff. In concert with these contacts, the Dare County Commissioners were briefed. Numerous personal contacts were made with local citizens, especially prominent hunters and trappers. The new refuge manager, John Taylor, provided great assistance in working with the citizens of Dare County.

Dare County residents are deeply rooted in outdoor pursuits, many earning part or all of their income from commercial fishing and shellfishing. Recreational hunting, fishing, and trapping are the norm for many residents. As might be expected, some viewed with great suspicion the Federal Government's acquiring essentially the major portion of their county and introducing a large predator on it. But a series of four public meetings in February 1986 clearly demonstrated that as long as traditional usages of the new refuge were not significantly altered, the local public would support a red wolf reintroduction effort. Based on this information, the Regional Director of the Southeast Region of the Service, in consultation with the Director of the North Carolina Wildlife Resources Commission, determined that the project was feasible. Field survey work was completed, pens were constructed, and a special regulation designating red wolves reintroduced at Alligator River National Wildlife Refuge as experimental and nonessential was promulgated and published in the Federal Register on November 19, 1986 (Parker et al. 1986). In culmination of these efforts, four pairs of adult red wolves were shipped from Tacoma, Washington, to the refuge on November 12, 1986.

In 1987, a new Red Wolf Recovery Team was appointed, consisting of Roland Smith, assistant director of the Point Defiance Zoo, Tacoma, Washington; Bill Malloy, administrative director of the Wild Canid Survival and Research Center, Eureka, Missouri; Michael Pelton, University of Tennessee, Knoxville, Tennessee; Don Wood, Florida Game and Fresh Water Fish Commission, Tallahassee, Florida; Curtis Carley, Service, Albuquerque, New Mexico; and Warren Parker, team leader,



ALLIGATOR RIVER
NATIONAL WILDLIFE REFUGE

PLATE 2

Service, Asheville, North Carolina. L. David Mech, Service, St. Paul, Minnesota, was designated as team technical advisor, and Mary Anne Young, Service, Atlanta, Georgia, was designated as Regional Office team advisor. Malloy and Carley resigned soon after their appointment; Victor Nettles, School of Veterinary Medicine, University of Georgia, replaced Malloy; and U. S. Seal, Veterans Administration Hospital, St. Paul, Minnesota, replaced Carley. The first team meeting was held at the refuge on December 2 and 3, 1987.

A primary facet in developing the Alligator River Refuge project was the use of a special tracking collar that had the capability of injecting an immobilizing drug upon radio command (Mech et al. 1984). The delivery of these collars was expected in May 1987. Because of unexpected delays in development of the 3-M Corporation capture collar, wolves were not released until September 1987, a major deviation from the proposed spring 1987 release. Since then seven more releases involving 12 different wolves have been conducted. Most animals have adjusted well to life in the wild. This adjustment was clearly demonstrated by the production of two litters in the wild during April 1988 and two litters in 1990. As of July 1990, there were nine free-ranging adult wolves in the refuge and an as yet undetermined number of pups born during the spring. In summary, the first 3 years of work in northeastern North Carolina indicate that it will be possible to restore a red wolf population to the Alligator River National Wildlife Refuge.

Island Propagation Strategy

A strategy to propagate wild red wolf offspring was initiated on November 19, 1987, when a pair of adult wolves was shipped from the captive-breeding project in Washington to Cape Romain National Wildlife Refuge, South Carolina. These animals were placed in an acclimation pen on Bulls Island and were allowed to breed. On April 22, 1988, four pups were born, two of which survived. On July 8 these young animals and their parents were released from the pen. Although the female parent was killed by an alligator (*Alligator mississippiensis*), the male and two pups adjusted well to life in the wild; in December 1988 the family unit was recaptured, and the two pups were taken to Alligator River Refuge and released. These pups adjusted to their new environment and offer great promise for the concept of island propagation. A replacement female red wolf was brought to Bulls Island in January 1989, and the adults were bred in the acclimation pen. Five pups were whelped, and the family unit was released on August 8, 1989. The replacement female was soon killed by an alligator, as was a pup. Hurricane Hugo hit the Bulls Island area in September 1989 and devastated the island's pristine overstory of live oaks and loblolly pine. The adult male and four pups survived the storm, but the male was later found dead, his death probably resulting from injuries sustained during the storm. Bulls Island continues to play an important role in red wolf recovery efforts. As of July 1990 a pair of juvenile animals are free on the island.

On January 10, 1989, a pair of captive adult red wolves was taken to Horn Island, Mississippi, for propagation purposes. This 3,500-acre (1,400-ha) island is a component of the National Park Service's Gulf Islands National Seashore. These adults bred in their acclimation pen and had seven pups. They were released from the pen on August 1, 1989, and adjusted extremely well to life in the wild. A third island project was recently initiated on St. Vincent National Wildlife Refuge in Florida. Two adults and their two pups were recently released onto this 12,000-acre (4800-ha) island refuge. The objective of these island projects is to gradually infuse wild red wolves into a project that, at the present time, has to depend on captive stock (Parker 1987b).

Recovery Potential

Probably the biggest factor weighing against the red wolf recovery effort is the notion that the species cannot survive in any association with coyotes. This conclusion is based on poorly understood factors that surrounded the hybrid swarm that threatened what was left of red wolf range in the 1970s (Nowak 1979). However, when red wolf numbers in Louisiana and Texas reached extreme lows, it became difficult, and in some cases impossible, for a lone red wolf to locate a mate. Under these unusual circumstances, interbreeding with coyotes took place, and, indeed, the red wolf as a species came dangerously close to losing its identity. Speciation, however, is a powerful force in nature. Red wolves and coyotes existed for thousands of years in central Texas and Oklahoma in narrow zones of sympatry. Man's intervention ultimately created a set of circumstances that simultaneously devastated red wolf habitat and populations. This alteration of a naturally occurring system permitted the more adaptable coyote to fill vacant, altered habitats. When man's attention finally turned to the plight of the red wolf, there was only a relict population to examine. We can now surmise that this population had been tempered by a host of biological, as well as environmental, factors.

In examining canid literature, it becomes obvious that there is a hierarchy among the various species. Sargeant et al. (1987) demonstrated spatial relationships between coyotes and red foxes in North Dakota, wherein a red fox population gradually declined as a coyote population increased. Other investigators have drawn the same conclusions regarding coyote/gray wolf range overlaps (Carbyn 1982, Mech 1970). Berg and Chesness (1978) and Fuller and Keith (1981) concluded that coyotes avoid wolf territories.

Since there are few large areas left within the historic range of the red wolf that are suitable for reintroduction purposes, it is important that these areas be critically examined as soon as practical. This is frustrated, however, by the fact that at least 80 percent of this historic range is now occupied by coyotes. Therefore, it is imperative that carefully designed projects be developed and executed that would measure impacts of any red wolves

introduced into areas with resident populations of coyotes. As of the date of this plan, a study is underway in the Great Smoky Mountains National Park in western North Carolina and eastern Tennessee to address this issue. If red wolves, like gray wolves, can compete with coyotes on good range, and thus develop a sympatric or allopatric relationship with resident coyotes, then long-term management objectives for the species would become more attainable.

In the interim, special red wolf propagation projects on small controlled island components of the national wildlife refuge system and national park system lands are of special interest. Young wild wolves born on these islands will be utilized in possible reintroduction efforts and in various captive-breeding projects. Yet even with these small island projects and three or more major mainland projects, the genetic vigor of the species needs to be heavily augmented with various captive-breeding projects. This reality is best expressed in numbers of red wolves that can be placed and managed in the wild. This figure would likely never exceed 200 to 250 animals. To maintain genetic variation and retard genetic drift within the species, it is likely that 300 to 350 red wolves will have to be continually maintained in captivity.

An important adjunct to reintroductions into the wild and captive breeding is the cryopreservation of red wolf semen and embryos. Significant advances have been made in recent years in the field of genetic banking, and these advances offer great promise in the maintenance of endangered species (Dresser 1988, Wildt et al. 1987).

Where mainland reintroduction attempts or island propagation strategies are found to be feasible, careful coordination with State agricultural and wildlife agencies is a must. The degree of direct State cooperation will depend on many factors, including political and budgetary constraints. In addition, the concerns of local property owners and residents must be addressed prior to approval of any wolf reintroduction project. NEPA documentation and special "experimental" regulations must also address public concerns. Without local citizen support, it is doubtful that successful wolf reintroductions can be accomplished.

The concerns of organized special interest groups, such as State and local Farm Bureau offices, local and national environmental organizations, hunting interests, livestock associations, etc., must also be recognized. The 1982 Amendments to the Endangered Species Act regarding experimental and nonessential designation of otherwise endangered animals, provides the Service with a powerful tool to allay public and institutional fears and concerns yet still provide protection for reintroduced animals.

Effective reintroduction strategies must always consider potentials for wolf/livestock interactions. While the special regulation referenced above will provide the legal mechanism for possible take of depredating red wolves, private livestock owners must also have

some means available for monetary compensation for animals killed by wolves. Techniques are available for designating predator kills or injuries (wolves, coyotes, bobcats), and cooperating private organizations can be enlisted to provide the financial resources needed for these projects. Red wolf reintroduction efforts should realistically avoid areas where a substantial livestock industry exists. Red wolves historically preyed on livestock, but practically all of these early incidents involved free-ranging stock. It is thought that present-day animal husbandry techniques of fencing and herd management will virtually preclude depredation problems. If such problems develop, the Service would act in concert with appropriate Federal and State agencies, especially Department of Agriculture, Animal Damage Control experts, to capture offending animals.

In conclusion, the Red Wolf Recovery Team is of the opinion that red wolf reintroductions are feasible in many areas of the Southeastern United States if carefully developed protocols and strategies are pursued within a framework of logic and realism.

PART II

A STRATEGY FOR CONSERVATION BASED ON VIABLE POPULATIONS

Introduction

Conservation strategies for endangered species must be based on viable populations. While it is necessary, it is not sufficient merely to protect endangered species *in situ.* They must also be managed.

Populations of many species maintained under the pressures of habitat degradation and unsustainable exploitation will be small; i.e., a few tens to a few hundreds (in some cases, even a few thousands) depending on the species. As such, these populations are endangered by a number of environmental, demographic, and genetic problems that are stochastic in nature and that can cause extinction.

Environmentally, small populations can be devastated by catastrophic events (disasters and epidemics), as exemplified by the case of the black-footed ferret, or devastated by even less drastic fluctuations in the environment. Demographically, small populations can be disrupted by random fluctuations in survivorship and fertility. Genetically, small populations lose diversity needed for fitness and adaptability.

Minimum Viable Populations (MVPs)

The smaller the population is and the longer the period of time it remains so, the greater these risks will be and the more likely extinction is to occur. As a consequence, conservation strategies for species which are reduced in number, and which most probably will remain that way for a long time, must be based on maintaining certain minimum viable populations; i.e., populations large enough to permit long-term persistence despite genetic, demographic, and environmental problems.

There is no single magic number that constitutes an MVP for all species or for any one species all the time. Rather, an MVP depends on both the genetic and demographic objectives for the program and the biological characteristics of the taxon or population of concern. A further complication is that current genetic, demographic, and environmental factors must be considered separately in determining MVPs, although there certainly are interactions between the genetic and demographic factors. Moreover, the scientific models for assessing risks in relation to population size are still in the early stages of development. Nevertheless, by considering both the genetic and demographic objectives of the program and the biological characteristics pertaining to the population, scientific analyses can result in ranges of population sizes that will provide calculated protection against stochastic problems.

Genetic and Demographic Objectives of Importance for MVP

1. The probability of survival (e.g., 50 percent or 95 percent) desired for the population;

2. The kind of genetic variation to be preserved (e.g., allelic diversity or average heterozygosity);

3. The percentage of the genetic diversity to be preserved (e.g., 90 percent, 95 percent, etc.); and

4. The period of time over which demographic security and genetic diversity are to be sustained (e.g., 50 years, 200 years).

In terms of demographic and environmental problems, for example, the objective may be 95 percent probability of survival for 200 years. Models are emerging to predict persistence times for populations of various sizes under threat. In terms of genetic problems, the objective may be to preserve 95 percent of average heterozygosity for 200 years. Again, models are available. However, it is essential to realize that such terms as viability, recovery, self-sustainment, and persistence can be defined only when quantitative genetic and demographic objectives have been established, including the period of time for which the program (and population) is expected to continue.

Biological Characteristics of Importance for MVP

Generation time: As populations decline in number, genetic diversity is lost generation by generation, not year by year. Hence, species with longer generation times will have fewer opportunities to lose genetic diversity within the given period of time selected for the program. As a consequence, to achieve the same genetic objectives, MVPs can be smaller for species with longer generation times. Generation time is qualitatively the average age at which animals produce their first offspring. Quantitatively, it is a function of the age-specific survivorships and fertilities of the population which will vary naturally and which can be modified by management; e.g., to extend generation time.

The number of founders. A founder is a constituent animal of a source population that establishes a derivative population. Technically, to constitute a full founder, an animal should also be unrelated to any other representative of the source population and non-inbred.

The more founders, the better. The more representative the sample of the source gene pool is, the smaller the MVP that is required for genetic stability. There is also a demographic founder effect--the larger the number of founders, the less likely extinction is due to demographic stochasticity. However, for larger vertebrates there is a point of diminishing return (Figure 1), at least in genetic terms. Hence a common objective is to obtain at least 20 to 30 effective

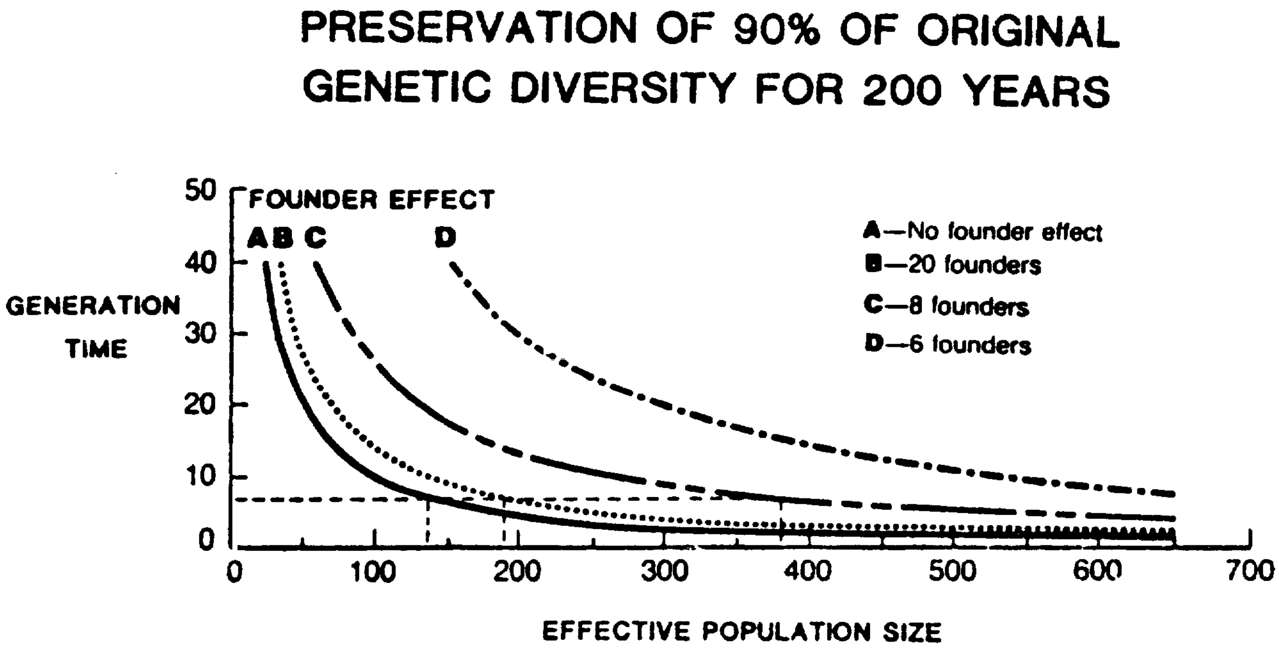


Figure 1

founders to establish a population. If this objective can't be achieved, one must do the best with what is available.

Effective Population Size. Another very important consideration is the effective size of the population, designated N_e. N_e is a measure of the way the members of the population are reproducing to transmit genes to the next generation. N_e is usually much less than N. For example, in the grizzly bear, N_e/N ratios of about .25 have been estimated (Harris and Allendorf 1989). As a consequence, if the genetic models prescribe an N_e of 500 to achieve some set of genetic objectives, the MVP might have to be 2,000.

Growth Rate. The higher the growth rate, the faster a population can recover from small size, thereby "outgrowing" much of the demographic risk and limiting the amount of genetic diversity lost during the so-called "bottleneck." It is important to distinguish MVPs from bottleneck sizes.

Population Viability Analysis (PVA)

The process of deriving MVPs by considering various factors; i.e., sets of objectives and characteristics, is known as Population Viability (sometimes Vulnerability) Analysis. Deriving applicable results in PVA requires interactive efforts of population biology

specialists with managers and researchers. PVA has already been applied to some degree to about 30 species.

Considering genetics, PVA in general indicates it will be necessary to maintain populations in hundreds or thousands to preserve a high percentage of the gene pool for several centuries.

MVPs, to contend with demographic and environmental stochasticity, may need be even higher than predicted to preserve genetic diversity, especially if a high probability of survival for an appreciable period of time is desired. For example, a 95 percent probability of survival may entail actually maintaining a much larger population whose persistence time is 20 times greater than required for 50 percent (i.e., average) probability of survival; 90 percent, 10 times greater. From another perspective, it can be expected that 50 percent of an actual population will become extirpated before 70 percent of the average persistence time elapses.

Larger vertebrates almost certainly need population sizes of several hundred or perhaps thousands to be viable. In view of the stochastic problems, more is always better.

Metapopulations and Minimum Areas

MVPs, of course, imply minimum critical areas of natural habitat that will be relatively vast for large carnivores like the red wolf. Consequently, it will be impossible to maintain single, contiguous populations of the hundreds or thousands required for viability.

However, it is possible for a number of smaller populations to be viable if they are managed as a single larger population (a so-called metapopulation) whose collective size is equivalent to the MVP. Actually, distributing animals over multiple "subpopulations" will increase the effective size of the total number maintained in terms of the capacity to withstand stochastic problems. Any one subpopulation may become extinct, or nearly so, due to these causes. But through recolonization or reinforcement from other subpopulations, the metapopulation will survive. Metapopulations occur in nature with much local extinction and recolonization of constituent subpopulations occurring.

Unfortunately, as wild populations become fragmented, natural migration for recolonization may become impossible. Hence, metapopulation management will entail interchanging animals to preclude or mitigate genetic and demographic problems. Migrants must reproduce in the new area, so in cases of managed migration, it will be important to monitor the genetic and demographic performance of the migrants.

MVPs strictly imply benign neglect. It is possible to reduce the MVP required for some set of objectives or, considered from an alternative perspective, extend the persistence time for a given size

population through management intervention to correct genetic and demographic problems as they are detected. In essence, many of these measures will increase N_e.

Management intervention for the red wolf after the first wild populations are established will include actions to improve juvenile survival (e.g., translocation of otherwise doomed dispersing young animals to available habitat to which they could not migrate naturally), introducing more breeding-age females to an area depauperate in this sex because of random biases toward males in a local area, accelerating turnover in dominant males that might be monopolizing breeding of multiple females and thereby causing distortion of sex ratios and family sizes with consequent depression of N_e, relocation of animals to prevent reproduction by close relatives, etc.

Such interventions are manifestations of the fact that as natural sanctuaries and their resident populations become smaller, they are in effect transformed into megazoos that require much the same kind of intensive genetic and demographic management as species in captivity.

Captive Propagation

Another way to enhance viability is to reinforce wild populations with captive propagation. The advantages of captive propagation include protection from unsustainable exploitation (e.g., poaching), moderation of environmental vicissitudes for at least part of the population, more genetic management and hence enhanced preservation of the gene pool, accelerated expansion of the population to move toward the desired MVP and to provide animals more rapidly for introduction into new areas, and increased total numbers of animals maintained.

It must be emphasized that the purpose of captive propagation is to reinforce, not replace, wild populations. Zoos must serve as reservoirs of genetic and demographic material that can periodically be infused into natural habitats to reestablish species that have been extirpated or to revitalize populations that have been debilitated by genetic and demographic factors.

The survival of a growing number of endangered species will depend in large part on assistance from captive propagation. Indeed, what appears optimal and inevitable are conservation strategies incorporating both captive and wild populations interactively managed for mutual support and survival. The captive population can serve as a vital reservoir of genetic and demographic material, whereas the wild population, if large enough, can continue to subject the species to natural selection. This general strategy has been adopted by the International Union for the Conservation of Nature and Natural

Resources (IUCN) which now recommends that captive propagation be invoked any time a taxon's wild population declines below 1,000 (IUCN 1988).

Zoos in many regions of the world are organizing scientifically-managed and highly-coordinated programs for captive propagation to reinforce natural populations. In North America, these efforts are being developed under the auspices of the AAZPA, the Captive Breeding Specialist Group (CBSG) of the IUCN, and are known as SSPs.

Captive propagation for species conservation purposes requires obtaining as many founders as possible; rapidly expanding the population (normally to several hundred animals); and managing the population closely, both genetically and demographically. Captive programs can also involve research to facilitate management in the wild as well as in captivity and for interactions between the two.

An example of a conservation/recovery strategy incorporating both captive and wild populations is the black-footed ferret. The species now evidently survives only in captivity. Because the decision to establish a captive population was delayed, the situation became so critical that moving all the animals into captivity seemed the only option, circumstances that also apply to the California condor. Another option may have been available if action to establish a captive population had occurred earlier. Consideration of the survivorship pattern, which exhibited high juvenile mortality for ferrets, suggested that young animals destined to die in the wild might be removed with little or no impact.

In general, AAZPA and CBSG have become involved in these kinds of strategies and programs worldwide. It should be emphasized that the kind of conservation strategy that has been delineated would apply regardless of how taxonomic problems of defining what constitutes separate entities to be preserved (i.e., evolutionary significant units [ESUs]) are resolved. The goal has to be to develop viable populations of each of the ESUs or phylogeographic units.

<u>Summary</u>

A conservation strategy or recovery plan based on viable populations for a taxon like the red wolf should:

1. Expand the population in numbers and in range (multiple populations of 50 to 100 each), all managed as a metapopulation.

2. Maintain a vigorous program of captive propagation to reinforce the wild populations.

3. Intervene in wild populations to ameliorate genetic, demographic, and environmental problems.

4. Conduct an extensive and continuing population viability analysis as situations change, knowledge increases, and science advances.

PART III

RED WOLF SPECIES SURVIVAL PLAN

The North American red wolf population numbered 131 animals in 19 facilities on July 1, 1990, with a sex ratio of 57 males to 74 females. Not included are two litters of pups born in the wild at Alligator River National Wildlife Refuge. As of the date of this recovery/species survival plan, the number and sex of these two litters is unknown. Included are a pair of juvenile animals in the wild on Bulls Island, a component of the Cape Romain National Wildlife Refuge in South Carolina, five juveniles in the wild on Horn Island, part of the Gulf Islands National Seashore in Mississippi, and two adults and their two pups just released into the wild on St. Vincent National Wildlife Refuge, Florida.

There are presently 19 zoos and captive facilities in the United States cooperating with the red wolf breeding program. These include the Alexandria Zoo (Louisiana), Audubon Park Zoo (Louisiana), Baton Rouge Zoo (Louisiana), Beardsley Zoo (Connecticut), Birmingham Zoo (Alabama), Burnet Park Zoo (New York), Fossil Rim Wildlife Center (Texas), Fresno Zoo (California), Knoxville Zoo (Tennessee), Land Between The Lakes (TVA, Kentucky), Los Angeles Zoo (California), Lowry Park Zoo (Florida), The National Zoo (Washington, D.C.), Oglebay Park Zoo (West Virginia), Point Defiance Zoo and Aquarium (Washington), Ross Park Zoo (New York), Tallahassee Junior Museum (Florida), The Texas Zoo (Texas), and the Wild Canid Survival and Research Center (Missouri).

Based on the information available, it is possible to identify several demographic trends for the red wolf population (useful demographic concepts and terms are explained on page 29).

1. The sex ratio is biased, currently showing 14 percent more females than males (Table 1). This reflects a greater production of females in the last 5 years and, on average, lower age-specific mortality for females for census years 1984-1989 (Tables 2 and 3).

2. The age distribution shows a healthy breeding group of prime adults that could rapidly expand the captive population to carrying capacity, while meeting the demands for the reintroduction program (Table 1 and Figure 2).

3. Age-specific survival and fertility rates are provided by the life table (Tables 2 and 3, Figure 3). The age-specific fertility rate for males is zero for those in the 0-2 age classes, increases steadily through the 8-11 age classes, then drops off to zero in the 14-15 plus age classes. Female age-specific fertility is slightly different, being low but greater than zero in the 0-2 age classes, increasing steadily

DEMOGRAPHY GLOSSARY

Age	**Age class in years.**
Px	**Age-specific survival.** Probability that an animal of a given age will survive to the next age class.
Lx	**Age-specific survivorship.** Probability of a newborn surviving to a given age class.
Mx	**Age-specific fertility.** Average number of offspring (of the same sex as the parent) produced by an animal in the given age class. Can also be interpreted as average percentage of animals that will reproduce.
r	Instantaneous rate of change. If $r < 0$ ...... Population is declining $r = 0$ ...... Population is stationary (Does not change in number) $r > 0$ .... Population is increasing
lambda	Percent of population change per year. If lambda < 1 ...... Population is declining lambda = 1 ...... Population is stationary (Does not change in number) lambda > 1 ...... Population is increasing
R_o	Net reproductive rate, the rate of change per generation. If $R_o < 1$ ...... Population is declining $R_o = 1$ ...... Population is stationary (Does not change in number) $R_o > 1$ ...... Population is increasing
G	Generation Time Average length of time between the birth of a parent and the birth of its offspring. Equivalently, the average age at which an animal produces its offspring)

RED WOLF
AGE STRUCTURE OF SSP POPULATION

9 JULY 1989

AGE CLASS IN YEARS	MALES	FEMALES
0 - 1	16	21
1 - 2	8	8
2 - 3	4	8
3 - 4	5	8
4 - 5	4	4
5 - 6	2	4
6 - 7	5	5
7 - 8	2	2
8 - 9	2	1
9 - 10	1	3
10 - 11	1	2
11 - 12	0	1
12 - 13	1	1
13 - 14	0	0
TOTALS	51	68

Table 1

RED WOLF
LIFE TABLE

(CAPTIVE POPULATION 01 APRIL 1966 - 01 JULY 1989)

MALES					FEMALES				
Age	Px	Lx	Mx		Age	Px	Lx	Mx	
0	0.492	1.000	0.000	r =	0	0.485	1.000	0.010	r =
1	0.702	0.492	0.000	0.0755	1	0.774	0.485	0.046	0.0793
2	0.928	0.345	0.074		2	1.000	0.375	0.443	
3	0.902	0.321	0.776	lambda =	3	0.843	0.375	0.520	lambda =
4	0.827	0.289	0.703	1.078	4	0.932	0.316	0.313	1.083
5	0.942	0.239	0.429		5	0.800	0.295	0.540	
6	0.860	0.225	0.929	Ro =	6	0.859	0.236	1.087	Ro =
7	0.730	0.194	0.978	1.729	7	0.782	0.203	0.933	1.596
8	0.859	0.141	0.611		8	0.778	0.158	1.175	
9	0.910	0.121	1.538	G =	9	0.823	0.123	1.622	G =
10	0.890	0.111	1.900	7.253	10	0.581	0.101	1.104	5.893
11	0.875	0.098	0.959		11	0.351	0.059	0.000	
12	0.505	0.086	0.331		12	1.000	0.021	0.000	
13	1.000	0.043	1.500		13	1.000	0.021	0.000	
14	0.500	0.043	1.203		14	1.000	0.021	0.000	
15	1.000	0.022	1.250		15	1.000	0.021	0.000	
16	1.000	0.022	0.000		16	1.000	0.021	0.000	
17	1.000	0.022	0.000		17	1.000	0.021	0.000	
18	1.000	0.022	0.000		18	1.000	0.021	0.000	
19	0.000	0.022	0.000		19	0.000	0.021	0.000	
20	0.000	0.000	0.000		20	0.000	0.000	0.000	

Table 2

RED WOLF
LIFE TABLE

(CAPTIVE POPULATION 01 JULY 1984 - 01 JULY 1989)

MALES

Age	Px	Lx	Mx	
0	0.603	1.000	0.000	r =
1	0.803	0.603	0.000	0.1237
2	1.000	0.484	0.075	
3	1.000	0.484	1.166	lambda =
4	0.900	0.484	0.418	1.132
5	1.000	0.436	0.117	
6	0.768	0.436	1.407	Ro =
7	0.674	0.335	0.806	2.140
8	0.772	0.226	0.000	
9	1.000	0.174	0.757	G =
10	1.000	0.174	0.000	6.150
11	0.733	0.174	0.415	
12	0.533	0.128	0.000	
13	1.000	0.068	0.888	
14	0.667	0.068	1.203	
15	1.000	0.045	1.250	
16	0.500	0.045	0.000	
17	1.000	0.023	0.000	
18	1.000	0.023	0.000	
19	0.000	0.023	0.000	
20	0.000	0.000	0.000	

FEMALES

Age	Px	Lx	Mx	
0	0.636	1.000	0.000	r =
1	0.895	0.636	0.000	0.0921
2	1.000	0.569	0.239	
3	0.856	0.569	0.550	lambda =
4	0.913	0.487	0.269	1.097
5	0.859	0.445	0.511	
6	0.870	0.382	0.729	Ro =
7	0.755	0.332	0.625	1.644
8	0.878	0.251	1.105	
9	1.000	0.220	0.331	G =
10	0.700	0.220	0.000	5.397
11	1.000	0.154	0.000	
12	1.000	0.154	0.000	
13	1.000	0.154	0.000	
14	1.000	0.154	0.000	
15	1.000	0.154	0.000	
16	1.000	0.154	0.000	
17	1.000	0.154	0.000	
18	1.000	0.154	0.000	
19	0.000	0.154	0.000	
20	0.000	0.000	0.000	

Table 3

RED WOLF
AGE STRUCTURE

01 JULY 1989

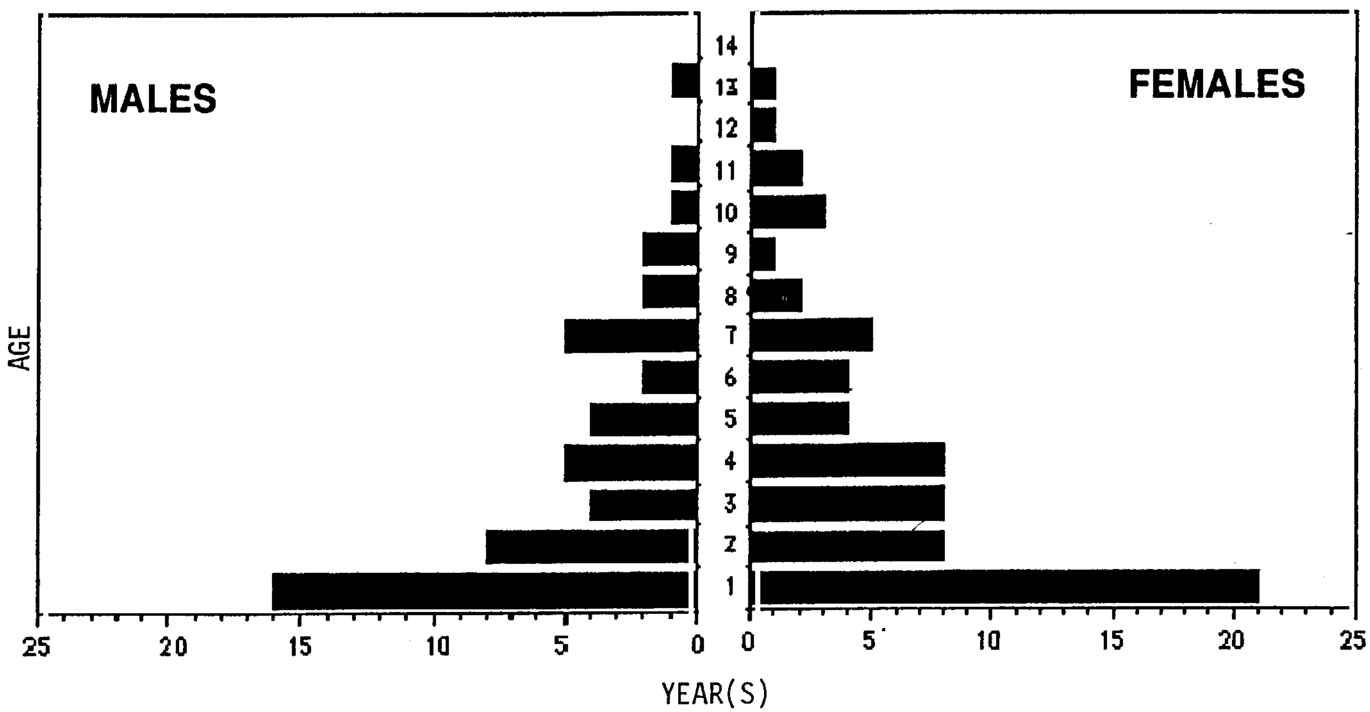
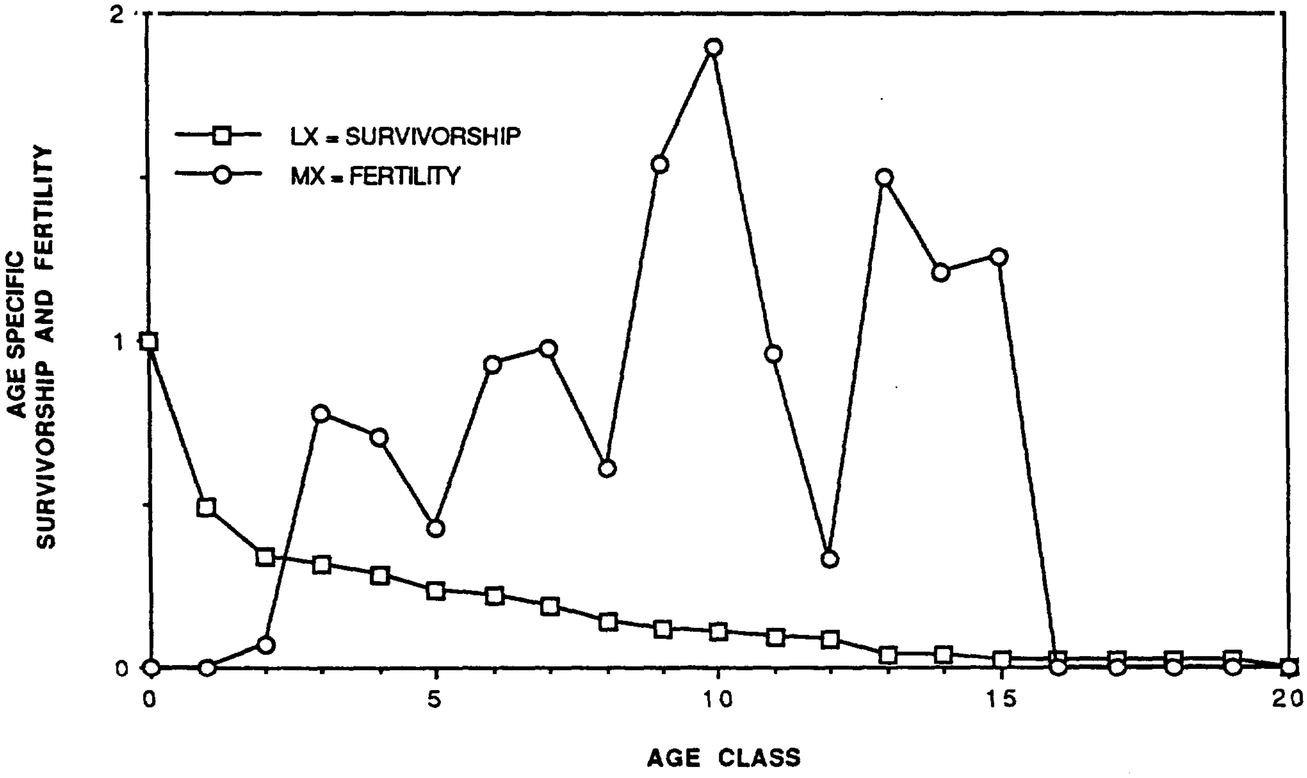


Figure 2

33

MALE POPULATION



FEMALE POPULATION

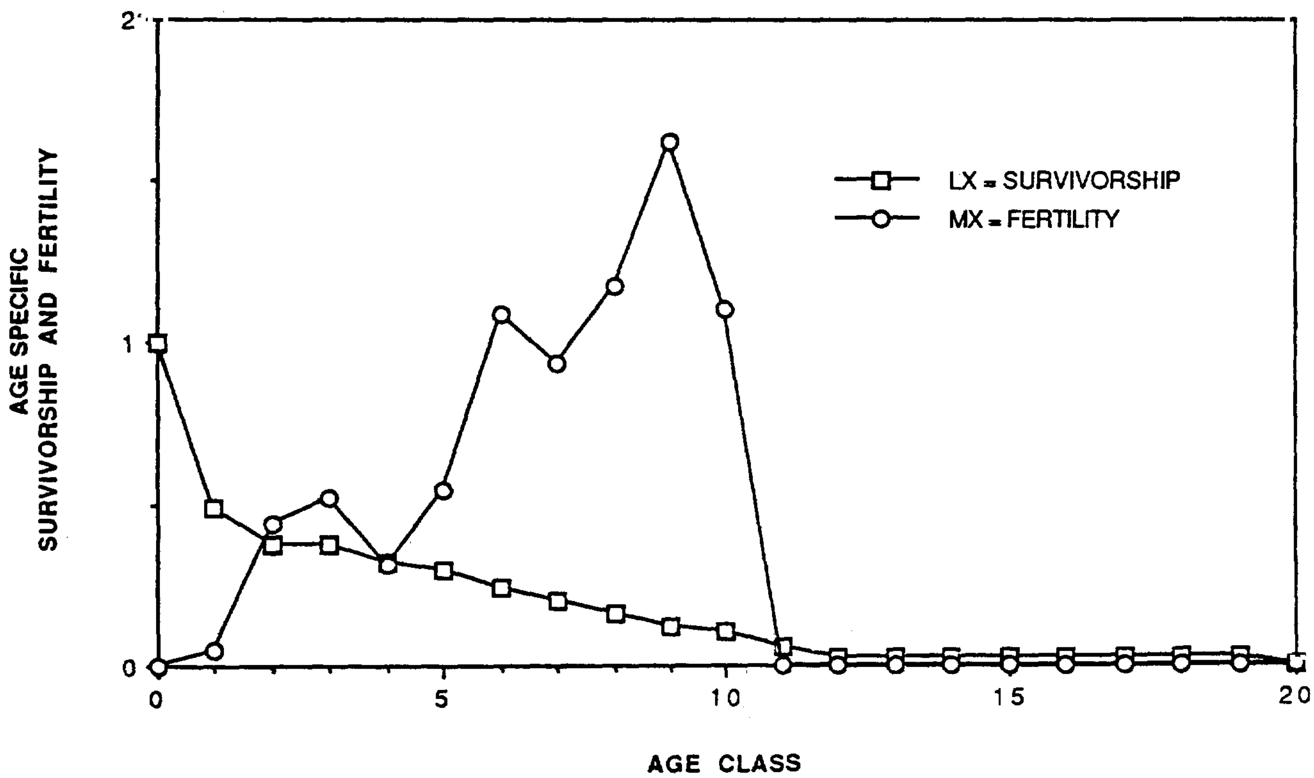


Figure 3

through the 6-11 age classes, then dropping to zero. Actual ages at first reproduction by individual animals are provided by Table 4.

4. While over the history of the population the average growth rate has been about 8 percent per year (i.e., lambda = 1.08), it is expected that the potential for increase could be expanded to 20 percent per year (lambda = 1.2; see Tables 2 and 3). Nevertheless, for some of the later calculations and projections, an intermediate figure of 10 percent (lambda = 1.1) has been used.

5. Generation time is different for males and females and has declined slightly in recent years (Tables 2 and 3). The average of both males and females is about 6.5 years. If there is an attempt to increase the rate of growth, the generation time will decline further. For purposes of the carrying capacity calculations, a generation time of 6 years has been used.

Genetically, there have been 14 potential founders (i.e., animals from the wild that have been moved into captivity) in the population (Tables 5, 6, and 7; a full explanation of genetic concepts and terms is provided on page 41). Of those, all have produced offspring. However, the effective number of founders is lower, as indicated by the Founder Genome Equivalents and the Number of Founder Genomes Surviving, which provide somewhat different measures of how the genetic diversity represented by the potential founders has been lost over the history of the captive population (Table 7).

There are three ways that the effective number of founders can be reduced below the actual number of animals moved into captivity from the wild:

1. The first and most obvious way is that some of the animals taken from the wild don't reproduce.

2. The second way is that some of the genes or alleles from each founder may be lost when its lineage passes through a bottleneck--a generation in which there are only one or a few offspring--so that not all of the founder's alleles are transmitted into the next generation. The most extreme example is when a founder has only one F_1 offspring. Then only one-half of the founder's genes will survive in the pedigree from that point onward. The number of Founder Genomes Surviving indicates how much loss has occurred due to bottlenecks. This number represents the maximum number of full founders from the wild (i.e., with no loss of their genomes) that would be required to contain as much genetic diversity as still exists in the captive population. As indicated in Table 7, the number of Founder Genomes Surviving is about 10.4.

RED WOLF
ACTUAL AGE AT FIRST REPRODUCTION

(HISTORICAL POPULATION)

MALES		FEMALES	
STUDBOOK	AGE/MONTH	STUDBOOK	AGE/MONTH
291	22	132	11
327	22	152	12
164	33	54	24
53	34	79	24
140	34	195	24
146	34	196	24
213	34	216	24
227	34	244	24
247	34	279	24
280	34	40	25
293	34	303	35
268	37	112	36
242	45	269	36
137	46	301	36
26	47	302	36
33	47	65	38
39	47	245	48
42	47	277	48
144	47	36	49
52	58	194	60
18	59	23	61
28	59	29	61
24	60	32	61
219	70	30	62
8	71	205	72
17	71	233	72
179	71	12	73
211	72	35	73
184	82	215	73
6	83	14	74
34	83	142	84
212	83	15	85
11	107	16	85
3	108	7	86
2	120	13	86

Table 4

RED WOLF
SSP POPULATION
GENE DROP ANALYSIS

9 JULY, 1989

0 = WILD; -1 = UNK

	ID	Sex	Sire	Dam	Status
1	6	M	0	0	D
2	8	M	0	0	D
3	11	M	0	0	D
4	12	F	0	0	D
5	13	F	0	0	D
6	14	F	0	0	D
7	16	F	0	0	D
8	17	M	0	0	D
9	24	M	0	0	D
10	26	M	0	0	D
11	30	F	0	0	D
12	33	M	0	0	D
13	34	M	0	0	D
14	42	M	0	0	D
15	52	M	6	12	A
16	53	M	6	12	D
17	54	F	6	12	A
18	79	F	8	16	A
19	111	F	33	14	A
20	112	F	33	14	D
21	132	F	6	12	A
22	135	M	24	30	A
23	137	M	17	132	D
24	142	F	11	54	A
25	143	F	11	54	A
26	146	M	42	79	D
27	152	F	53	14	D
28	155	F	53	14	A
29	164	M	6	13	D
30	165	M	6	13	A
31	179	M	24	152	A
32	180	M	24	152	A
33	184	M	34	132	D
34	194	F	8	13	D
35	195	F	8	13	A
36	196	F	26	54	D
37	205	F	11	54	A
38	208	M	52	132	A
39	211	M	24	112	D
40	212	M	24	112	A
41	213	M	24	112	D
42	215	F	24	112	A
43	216	F	24	112	D
44	219	M	53	79	A
45	221	F	53	79	A
46	222	F	53	79	A
47	224	M	11	54	A
48	225	M	11	54	A
49	227	M	164	196	A
50	233	F	146	152	A

Table 5

RED WOLF
SSP POPULATION
GENE DROP ANALYSIS

9 JULY, 1989

0 = WILD; -1 = UNK

	ID	Sex	Sire	Dam	Status
51	242	M	52	195	A
52	243	F	52	195	A
53	244	F	52	195	D
54	245	F	52	195	A
55	247	M	11	54	A
56	248	F	11	54	A
57	251	F	146	216	A
58	252	F	146	216	A
59	253	F	146	216	A
60	255	M	137	112	A
61	268	M	53	79	A
62	269	F	53	79	A
63	270	F	53	79	A
64	272	M	11	54	A
65	277	F	34	132	A
66	278	F	34	132	A
67	279	F	34	132	D
68	280	M	213	244	A
69	282	M	213	244	A
70	289	F	213	244	A
71	291	M	213	244	A
72	292	M	213	244	A
73	293	M	213	244	A
74	294	M	24	196	A
75	297	F	24	196	A
76	299	M	227	194	A
77	300	F	227	194	A
78	301	F	227	194	A
79	302	F	227	194	A
80	303	F	227	194	A
81	304	F	227	194	A
82	305	F	227	194	A
83	312	M	242	279	A
84	313	F	242	279	A
85	315	F	242	279	A
86	316	F	242	279	A
87	319	M	52	142	A
88	321	F	179	245	A
89	322	F	179	245	A
90	323	F	179	245	A
91	324	F	179	245	A
92	325	F	179	245	A
93	327	M	179	245	A
94	328	M	179	245	A
95	331	M	242	279	A
96	332	M	242	279	A
97	351	F	184	205	A
98	347	F	280	269	A
99	350	M	280	269	A
100	349	M	280	269	A

Table 5 (Cont.)

RED WOLF SSP POPULATION GENE DROP ANALYSIS

9 JULY, 1989

0 = WILD; -1 = UNK

	ID	Sex	Sire	Dam	Status
101	348	F	280	269	A
102	336	M	213	245	A
103	338	F	213	245	A
104	335	M	213	245	A
105	344	F	211	196	A
106	337	F	213	245	A
107	339	F	213	245	A
108	346	M	291	289	A
109	342	F	268	215	A
110	341	M	268	215	A
111	352	M	219	303	A
112	353	M	219	303	A
113	354	M	219	303	A
114	356	M	293	301	A
115	357	M	293	301	A
116	358	M	293	301	A
117	359	M	293	301	A
118	360	F	293	301	A
119	361	F	293	301	A
120	362	M	268	277	A
121	363	F	268	277	A
122	364	F	268	277	A
123	368	M	291	233	A
124	369	M	291	233	A
125	371	F	291	233	A
126	372	M	280	245	A
127	373	M	280	245	A
128	374	M	280	245	A
129	375	F	280	245	A
130	376	F	280	245	A
131	377	F	280	245	A
132	378	F	280	245	A
133	379	F	242	289	A
134	380	F	242	289	A
135	381	F	242	289	A
136	382	F	242	289	A
137	383	F	242	289	A
138	386	M	212	195	A
139	387	M	212	195	A
140	388	F	212	195	A
141	389	F	212	195	A
142	390	F	212	195	A
143	391	F	212	195	A
144	392	M	227	205	A
145	393	F	227	205	A
146	394	F	227	205	A
147	395	F	227	205	A

119 Living Descendants 147 In total pedigree

Table 5 (Cont.)

RED WOLF
SSP POPULATION
FOUNDER ALLELE REPRESENTATION

10 JULY, 1989

FOUNDER	RETENTION	% REPRESENTATION	TARGET	DIFFERENCE
6M	0.978	18.913	9.385	-9.528
8M	0.866	13.713	8.310	-5.402
11M	0.996	4.620	9.553	4.933
12F	0.942	16.546	9.035	-7.512
13F	0.899	12.156	8.627	-3.529
14F	0.931	6.946	8.934	1.988
16F	0.500	3.453	4.798	1.345
17M	0.235	0.198	2.260	2.062
24M	0.997	11.846	9.562	-2.284
26M	0.470	2.368	4.510	2.142
30F	0.500	0.420	4.798	4.378
33M	0.744	4.722	7.135	2.412
34M	0.899	2.956	8.627	5.671
42M	0.466	1.142	4.467	3.325

Table 6

GENETIC SUMMARY

	LIVING DESCENDANT POPULATION	POTENTIAL
Number of founders:	14	14
Parity (%):	7.143	7.143
Mean retention :	0.744	0.744
Founder Genomes Surviving :	10.421	10.421
Founder Genomes Equivalents :	7.513	10.421
Founder Equivalents :	8.148	12.619
Fraction of wild heterozygosity retained :	0.906	0.952
Fraction of wild heterozygosity lost :	0.094	0.048
Mean inbreeding coefficient realized :	0.041	

Table 7

GENETICS GLOSSARY

GENOME
The complete set of genes (alleles) carried by an individual.

RETENTION
Fraction of founder's original set of genes (genomes) still present in the population.

EXSISTING REPRESENTATION
The existing percentage representation of founders in the population.

TARGET REPRESENTATION
The desired target percentage representation of founders. These target figures are proportional to the fraction of each founder genome that survived. Achieving these target representation values will maximize preservation of genetic diversity.

DIFFERENCE
(Existing Representation) - (Target Representation)

A minus sign (-) designates a founder that is over - represented.

POTENTIAL FOUNDER
An animal from a source population (e.g., the wild) that establish a derived population (e.g., a captive or new wild population).

FOUNDER
An animal form a source (e.g., wild) population that actually produced offspring and have descendants in the living derived (e.g., captive) population.

The minus sign (-) designates the unknown mate of the founder with that number.

MEAN RETENTION
Average fraction of each founder genome surviving in the population.

MEAN HETEROZYGOSITY
Average fraction of original heterozygosity remaining in the population.

BOTTLENECK
A generation in the lineage from a founder when only one or a few offspring are produced so that not all of the founder's alleles are transmitted onto the next generation.

FOUNDER GENOME SURVIVING
The sum of the allelic retention; i.e., the number of founder genomes still in the population. This metric measure loss of original diversity due to bottlenecks in the pedigree of the population.

FOUNDER GENOME EQUIVALENTS
The number of newly wild caught animals required to obtain the genetic diversity in the present captive population. This metric reflects loss due to both bottlenecks and disparities in the founder representation.

3. The third way is for the representation of the founders in the living population to be very disparate. Even though some fraction of the genome (original alleles) of a founder may be surviving, the actual number of copies of each founder's alleles currently present in the population is also very important. If some founder alleles are very common in the population, but others are very rare, the effective number of founders will be reduced because there is a high risk that the less common alleles will soon be lost. Founders have not contributed equally to the red wolf population (Table 6 and Figure 4). Representation of founders can be redressed to a substantial extent by regulating reproduction of their descendants.

   Founder Genome Equivalents adds these reductions to the loss due to bottlenecks (i.e., Founder Genomes Surviving) to estimate the actual effective numbers of founders in the living population. If management acts to rectify the disparities in founder distribution (i.e., so the founder representation in the population moves from the existing to the target distribution), the effective number of founders can be increased from the Founder Genome Equivalents level to the Number of Founder Genomes Surviving.

As a consequence of factors 2 and 3, the number of effective founders for the red wolf population is currently about 8 but could be increased to about 12.6 through better management to reduce disparities in founder lineage representation. It is estimated that about 91 percent of the original heterozygosity in the wild population is still present in the captive population under existing management. This level could be increased to 95 percent if management is improved.

Employing the data provided by the previous genetic and demographic analysis and using a software program developed by Dr. Jonathan Ballou, a PVA has been performed relative to genetic considerations to estimate MVPs necessary for various objectives (Tables 8a-g). Even with conservative case scenarios relative to parameters (effective founder number of 8, an N_e/N ratio of 0.3, a generation time of 6 years, and an annual growth rate [lambda] of 10 percent), it has been calculated that a captive population of 320 animals and a reintroduced wild population of 220 red wolves would be able to maintain 80 to 85 percent of the original genetic diversity from the captured wild stock that probably occurred in the wild gene pool of red wolves. Retention of 80 to 85 percent of original heterozygosity is equivalent to preserving at least 90 percent of the heterozygosity that still exists (i.e., 90 percent of the 92 to 95 percent of the original that still exists).

The current population of red wolves is reproducing reliably but cannot be considered a self-sustaining population because of the low total numbers. Animals can be moved to reproductive situations almost as quickly as new captive habitats are provided. However,

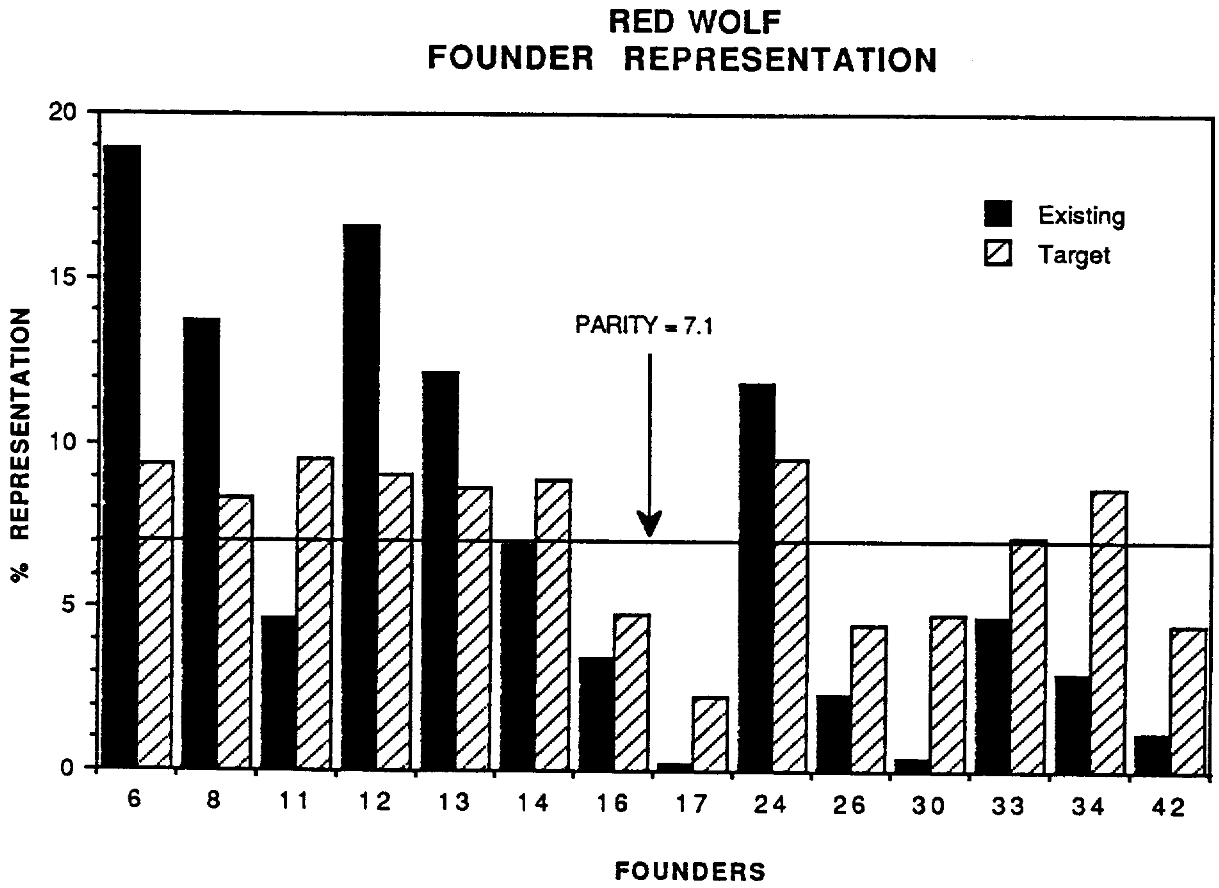

RED WOLF
FOUNDER REPRESENTATION
% REPRESENTATION
20
15
10
5
0
Existing
Target
PARITY = 7.1
6
8
11
12
13
14
16
17
24
26
30
33
34
42
FOUNDERS

Figure 4

RED WOLF
CALCULATIONS FOR CARRYING CAPACITY

Capacity 2.11

Effective Size and Carrying Capacity Necessary for Maintaining the Specified Amount of Genetic Diversity for the Specified Amount of Time

Number of Years per Generation :	6.0	# Generation during 200 Years :	33
Yearly Growth Rate (lambda) :	1.100	Exponential Growth Rate (r) :	0.095
Effective Number of Founders :	10	Growth rate per Generation :	1.772
Estimated Ne/N Ratio :	0.40	Exponential Growth/Generation :	0.572
Desired % Hetero. Retain :	80.0		
Length of Time Period (Years):	200		

Effective Size Required to Maintain 80.0% of the Original Founder's Heterozygosity for 200 Years: 124

Actual Carrying Capacity Required (Based on Ne/N Ratio) : 310

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Table 8a

RED WOLF
CALCULATIONS FOR CARRYING CAPACITY

Capacity 2.11

Actual Carrying Capacity Required to Maintain 80.0% of the Original Heterozygosity for Different Founder #s Under Various Ne/N Ratios

No. EFFECTIVE FOUNDERS

Ne/N Ratio	7	8	9	10	11
0.30	747	553	463	413	380
0.40	560	415	348	310	285
0.50	448	332	278	248	228
0.60	373	277	232	207	190
0.70	320	237	199	177	163

Table Parameters

Lambda :	1.100
Gen. Length :	6.0
Time Period :	200

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Table 8b

Capacity 2.11

Actual Carrying Capacity Required to Maintain 80.0% of the Original Heterozygosity for Various Time Periods Under Various Ne/N Ratios

LENGTH OF PROGRAM (YEARS)

Ne/N Ratio	50	100	150	175	200
0.30	70	170	297	353	413
0.40	53	128	223	265	310
0.50	42	102	178	212	248
0.60	35	85	148	177	207
0.70	30	73	127	151	177

Table Parameters

Lambda :	1.100
Gen. Length :	6.0
No. Fndrs :	10

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Table 8c

RED WOLF
CALCULATIONS FOR CARRYING CAPACITY

Capacity 2.11

Actual Carrying Capacity Required to Maintain 80.0% of the Original Heterozygosity for Various Time Periods Given Various Founder Numbers

LENGTH OF PROGRAM (YEARS)

No. Effective Founders	50	100	150	175	200
7	75	213	393	475	560
8	63	165	295	355	415
9	58	143	250	300	348
10	53	128	223	265	310
11	50	120	205	245	285

Table Parameters	
Lambda :	1.100
Gen. Length :	6.0
Ne/N Ratio :	0.40

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Table 8d

Capacity 2.11

Actual Carrying Capacity Required to Maintain Various Levels of Heterozygosity for 200 Years with Various Numbers of Founders

PERCENT HETEROZYGOSITY RETAINED

No. Effective Founders	70.0	75.0	80.0	85.0	90.0
7	178	273	560	****	****
8	163	235	415	1783	****
9	153	213	348	930	****
10	145	200	310	683	****
11	140	190	285	563	****

Table Parameters	
Lambda :	1.100
Gen. Length :	6.0
Ne/N Ratio :	0.40

**** = Not possible with these parameters

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Table 8e

RED WOLF
CALCULATIONS FOR CARRYING CAPACITY

Capacity 2.11

Actual Carrying Capacity Required to Maintain Various Levels of Heterozygosity for Various Ne/N Ratios for 200 Years

PERCENT HETEROZYGOSITY TO RETAIN

		70.0	75.0	80.0	85.0	90.0
	0.30	193	267	413	910	****
Ne/N	0.40	145	200	310	683	****
Ratio	0.50	116	160	248	546	****
	0.60	97	133	207	455	****
	0.70	83	114	177	390	****

Table Parameters

Lambda :	1.100
Gen. Length :	6.0
No. Fndrs :	10

**** = Not possible with these parameters

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Table 8f

Capacity 2.11

Actual Carrying Capacity Required to Maintain Various Levels of Heterozygosity for Various Time Periods Given 10 Effective Founders

LENGTH OF PROGRAM (YEARS)

		50	100	150	175	200
	70.0	30	65	105	125	145
Percent	75.0	38	85	145	173	200
Heter.	80.0	53	128	223	265	310
Retained	85.0	95	263	480	580	683
	90.0	****	****	****	****	****

Table Parameters

Lambda :	1.100
Gen. Length :	6.0
Ne/N Ratio :	0.40

**** = Not possible with these parameters

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Table 8g

many more captive spaces must be provided if the species is expected to retain the current level of genetic diversity.

It is interesting to note that gray wolves in captivity number 321 animals (160 male and 161 female) in 49 facilities throughout North America, and the coyote numbers 59 animals (26 male and 33 female) in 30 facilities. Perhaps some of these spaces could accommodate red wolves as they become available for various reasons.

The Goal of the SSP Population

The propagation goal of the Service's Red Wolf Recovery Team and the Red Wolf SSP Propagation Group for the red wolf is to maintain 80 to 85 percent of the genetic diversity found in the original founder stock for a period of 150 plus years. This goal is equivalent to preserving 90 percent of the heterozygosity present in the existing captive population.

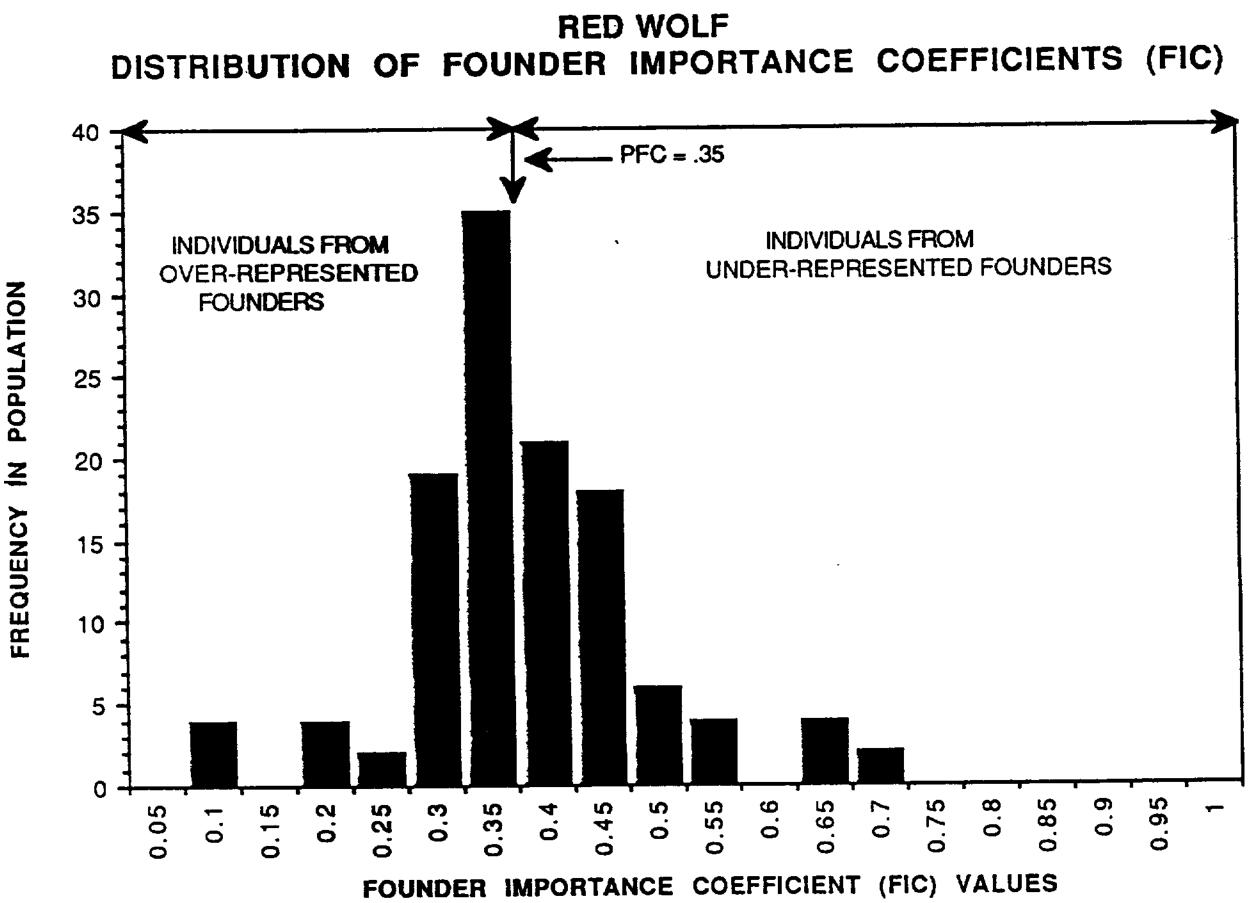
As derived pursuant to the above, a captive population of 330 wolves and a reintroduced wild population of 220 wolves are needed to achieve this goal. It is assumed that a captive population of 330 will have an effective population (N_e) of 125, and a wild population will have an N_e of 75. It is also assumed that various factors affecting MVP determination do not deteriorate further; e.g., more bottleneck loss of founder genes, decline in N_e/N ratios, or growth rate.

An important objective in this regard is to adjust the representation of founder lineages from the existing to the target distribution, requiring that, during this period of adjustment, representatives of under-represented founder lineages be reproduced more than representatives of over-represented founders. A summary measure to identify which animals represent under-represented versus over-represented founders is provided by the Founder Importance Coefficient of each animal (Figure 5 and Supplement).

Once founder distribution is adjusted, it will then be important to maximize effective population size (N_e) by regulating family sizes. N_e can also be increased immediately by maximizing recruitment of animals as breeders.

Because the captive population is approximately one-third of what is needed, and because the wild population is currently less than 2 percent of estimated need, there must be maximum expansion of the population over the next several years.

Red wolves are monestrous and typically persist as monogamous pairs. The mean litter size for the species is five. These parameters will determine the number of pairs breeding per year, which equals the number of enclosures where breeding occurs in that year after a target production level has been established in any given year. To achieve the above goals, it is calculated that 84 births are needed



RED WOLF
DISTRIBUTION OF FOUNDER IMPORTANCE COEFFICIENTS (FIC)
PFC = .35
INDIVIDUALS FROM OVER-REPRESENTED FOUNDERS
INDIVIDUALS FROM UNDER-REPRESENTED FOUNDERS
FREQUENCY IN POPULATION
0
5
10
15
20
25
30
35
40
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
FOUNDER IMPORTANCE COEFFICIENT (FIC) VALUES

Figure 5

Figure 5 Supplement

RED WOLF

FOUNDER IMPORTANCE COEFFICIENT (FIC)

The Founder Importance Coefficient (FIC) can be used to initially identify individuals as being descended from over versus under-represented founders. Individuals who are descendants from over-represented founders will have low Founder Importance Coefficients; those that are descendants from under-represented founders will have high Founder Importance Coefficients. The Founder Importance Coefficient is the weighted- average of an individual's founder contributions with the
overall population founder contributions acting as the weights. The weighted average is standardized so that it ranges between 0 and 1. If the most over-represented founder is still alive, it will have a Founder Coefficient of 0; the most under-represented founder (if alive) will have a Founder Coefficient of 1.0.

The FIC is the weighted average of all the founder contributions to that individual with the weights being the overall founder contribution of each founder to the SSP population:

$$FIC_i = \sum_{j=1}^{NF} (OFC_j * FC_{ij})$$

where: OFC_i is the Overall Founder Contribution of Founder j to the SSP population.

FC_{ij} is the representation of founder j to individual i.

NF is the total number of founders.

The values are then standardized as follows:

$$\text{Std FIC} = \frac{(MAX - FIC)}{(MAX - MIN)}$$

where: FIC is as described above.

MAX is the Maximum FIC and is the OFC for the most over-represented founder.

MIN is the Minimum FIC and is the OFC for the most under-represented founder.

- -

POPULATION FOUNDER COEFFICIENT (PFC)

The Population Founder Contribution (PFC) is the Founder Importance Coefficient of a hypothetical individual whose founder contributions are equal to the actual contributions of each founder in the population. Therefore, individuals with Founder Importance Coefficients higher than the PFC are descendants of under-represented founders and those with lower Founder Importance Coefficients are descendants of over-represented founders.

In the case of the red wolf an individual with founder contributions equal to the Population Founder Contribution (PFC) will have a Founder Importance Coefficient of .35. Individuals in the population with Founder Importance Coefficients > .35 are carrying genes that may help the population reach the Target Founder Contribution goal, those with Founder Importance Coefficients < .35 may not significantly contribute toward achieving this goal.

per year for the next 5 years. Given a mean litter size of five, this means that 17 litters must be produced per year (Table 9).

Captive habitat should be increased by increasing the number of widely separated captive facilities and by upgrading existing facilities. There are two reasons for this. First and foremost, this will help minimize stochastic problems experienced by small populations due to demographic, environmental, and genetic uncertainty. Second, each participating SSP institution will increase public awareness of the red wolf recovery program by local and regional residents by virtue of pup births and accompanying local media stories and by education/outreach programs. A minimum of 20 to 25 new facilities, as well as the expansion of existing facilities, is necessary to accommodate 250 additional animals in the captive-population program. Also, a substantial number of additional Federal or State wildlife management units will have to be recruited to manage the 220 free-ranging wolves needed to maintain genetic diversity over the long term.

Clearly, the goals of this program are dependent upon the availability of suitable wild and captive habitats and the continued cooperation and active support from local, State, and Federal agencies, zoos, and the residents surrounding potential and existing reintroduction sites.

Specific Objectives

Using the rationale outlined above, specific objectives have been developed to serve as guidelines in establishing institution-by-institution and animal-by-animal recommendations. These objectives are:

1. Develop a captive population of at least 330 animals and a wild population of at least 220 animals in order to preserve 80 to 85 percent of the average heterozygosity of the original wild population (equivalent to 90 percent of the existing heterozygosity in the captive population) for the next 150 plus years.

2. Maintain a stable, self-sustaining population of red wolves in captivity and in the wild.

3. Continue the evaluation of the taxonomic status of the red wolf with a review of current literature. Determine, through mitochondrial DNA analysis and other biochemical techniques, the status of *Canis rufus* in the family Canidae.

4. As the captive population increases, design and implement complete reproductive physiology studies.

5. Adjust founder lineage representation from the existing to the target distribution.

RED WOLF
BIRTH LIMITS

9 JULY 1989

Number of births required to maintain a stationary population at a given carrying capacity.

CARRYING CAPACITY			BIRTHS REQUIRED		
MALES	FEMALES	TOTAL	MALES	FEMALES	TOTAL
25	25	50	6	7	13
50	50	100	12	14	26
75	75	150	18	22	40
100	100	200	24	29	53
125	125	250	31	36	67
150	150	300	37	44	81
175	175	350	43	51	94
200	200	400	49	58	107

Table 9

6. Increase the number of effective founders from 8 to 10.5.

7. Improve N_e/N from the existing 0.1-0.3 to 0.4.

8. Expand the carrying capacity of the Graham breeding facility to at least double its present capacity.

9. Recruit at least 25 new facilities with captive habitats to accommodate 140 additional red wolves.

10. Require each captive holding/propagation facility to house a minimum of 2.2 red wolves and their offspring until they can be placed in other facilities.

11. Provide at least 12 animals every other year for reintroduction purposes for the next 5 years.

12. Develop a model by which the Service can predict the approximate number of red wolves needed for each reintroduction site.

13. Evaluate completely all nonreproductive animals to ascertain cause of reproductive inactivity.

14. Monitor a release program for potential interactions of red wolves with other species, especially *Canis latrans*.

15. Develop a sperm- and embryo-banking strategy and initiate an active program with a qualified facility.

Following is an animal-by-animal distribution list of living red wolves as of August 1990.

Page # 1

RED WOLF (Canis rufus gregoryi)
Historical list of captive population
Printed on: 13.Feb.1991

Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # / Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
1	F	WILD	WILD	01.04.66	18.02.75		TACOMA	USA	13.02.69	9C6	0001	SSP	0	0	107 M
							TACOMA	USA WA	13.02.69						
2	M	WILD	WILD	01.04.67	12.07.81		TACOMA	USA	12.07.81	76103	0019	SSP	0	0	171 M
							TACOMA	USA WA	31.08.76						
3	M	WILD	WILD	01.04.68	11.07.80		TACOMA	USA	20.02.71	2010	0003	SSP	0	0	147 M
							TACOMA	USA WA	20.02.71						
4	F	WILD	WILD	01.04.68	15.12.76		TACOMA	USA	19.10.74	74098	0008	SSP	0	0	104 M
							TACOMA	USA WA	19.10.74						
5	F	WILD	WILD	01.04.69	26.01.79		TACOMA	USA	02.05.77	77022	0030	SSP	0	0	118 M
							TACOMA	USA WA	02.05.77						
6	M	WILD	WILD	01.04.70	23.06.82		TACOMA	USA	06.02.74	74001	0004	SSP	0	0	147 M
							TACOMA	USA WA	06.02.74						
7	F	WILD	WILD	01.04.70	23.04.79		TACOMA	USA	03.11.70	1099	0002	SSP	0	0	109 M
							TACOMA	USA WA	03.11.70						
8	M	WILD	WILD	01.04.71	26.04.85		TACOMA	USA	31.07.74	74093	0006	SSP	0	0	169 M
							TACOMA	USA WA	31.07.74						
9	M	WILD	WILD	01.04.71	08.04.75		TACOMA	USA	12.10.74	74102	0007	SSP	0	0	48 M
							TACOMA	USA WA	12.10.74						
10	M	WILD	WILD	01.04.71	31.03.78		TACOMA	USA	21.01.76	76044	0010	SSP	0	0	84 M
							TACOMA	USA WA	21.01.76						
11	M	WILD	WILD	01.04.71	11.11.88		TACOMA	USA	30.09.75	75114	0015	SSP	0	0	211 M
							WCSRC	USA WA	20.10.81						
12	F	WILD	WILD	01.04.71	17.03.83		TACOMA	USA	06.02.74	74002	0005	SSP	0	0	144 M
							TACOMA	USA WA	06.02.74						
13	F	WILD	WILD	01.04.71	01.05.81		TACOMA	USA	28.02.75	75016	0012	SSP	0	0	121 M
							TACOMA	USA WA	28.02.75						
14	F	WILD	WILD	01.04.71	03.09.81		TACOMA	USA	31.08.76	76102	0018	SSP	0	0	125 M
							TACOMA	USA WA	31.08.76						
15	F	WILD	WILD	01.04.71	28.07.82		TACOMA	USA	03.10.76	76123	0020	SSP	0	0	136 M
							TACOMA	USA WA	03.10.76						
16	F	WILD	WILD	01.04.71	25.11.78		TACOMA	USA	06.10.76	76124	0022	SSP	0	0	92 M
							TACOMA	USA WA	06.10.76						
17	M	WILD	WILD	01.04.72	22.12.80		TACOMA	USA	02.02.75	75012	0009	SSP	0	0	105 M
							TACOMA	USA WA	02.02.75						
18	M	WILD	WILD	01.04.72	07.08.82		DR. LONG	USA	26.02.75	75015	0013	SSP	0	0	124 M
							DR. LONG	USA WA	26.02.75						

RED WOLF (Canis rufus gregoryi)
Historical list of captive population
Printed on: 13.Feb.1991

Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # / Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
19	M	WILD	WILD	01.04.72	03.04.81		TACOMA	USA	21.02.76	75081	0014	SSP	0	0	108 M
							TACOMA	USA NA	21.02.76						
20	M	WILD	WILD	01.04.72	15.12.76		TACOMA	USA	03.10.76	76132	0021	SSP	0	0	56 M
							TACOMA	USA NA	03.10.76						
21	M	WILD	WILD	01.04.72	15.12.77		DR. LONG	USA	18.11.77	77072	0037	SSP	0	0	68 M
							DR. LONG	USA NA	18.11.77						
22	F	WILD	WILD	01.04.72	01.04.77		TACOMA	USA	21.01.76	76045	0011	SSP	0	0	60 M
							TACOMA	USA NA	21.01.76						
23	F	WILD	WILD	01.04.72	28.06.77		TACOMA	USA	03.10.76	76131	0023	SSP	0	0	63 M
							TACOMA	USA NA	03.10.76						
24	M	WILD	WILD	01.04.73	17.06.89		TACOMA	USA	20.04.76	76056	0017	SSP	0	0	195 M
							TACOMA	USA NA	20.04.76						
25	M	WILD	WILD	01.04.73	21.08.80		TACOMA	USA	21.01.77	77007	0027	SSP	0	0	89 M
							TACOMA	USA NA	21.01.77						
26	M	WILD	WILD	01.04.73	22.01.85		DR. LONG	USA	17.03.77	77045	0032	SSP	0	0	142 M
							TACOMA	USA NA	16.06.80						
27	M	WILD	WILD	01.04.73	09.09.77		DR. LONG	USA	27.04.77	77051	0035	SSP	0	0	53 M
							DR. LONG	USA NA	27.04.77						
28	M	WILD	WILD	01.04.73	12.08.79		DR. LONG	USA	18.11.77	77073	0038	SSP	0	0	76 M
							TACOMA	USA NA	09.01.79						
29	F	WILD	WILD	01.04.73	08.11.79		TACOMA	USA	04.11.75	75118	0016	SSP	0	0	79 M
							TACOMA	USA NA	04.11.75						
30	F	WILD	WILD	01.04.73	05.11.80		TACOMA	USA	01.02.77	77019	0028	SSP	0	0	91 M
							TACOMA	USA NA	01.02.77						
31	F	WILD	WILD	01.04.73	06.04.81		DR. LONG	USA	17.03.77	77044	0031	SSP	0	0	96 M
							DR. LONG	USA NA	17.03.77						
32	F	WILD	WILD	01.04.73	15.11.78		DR. LONG	USA	28.03.78	78031	0039	SSP	0	0	67 M
							DR. LONG	USA NA	28.03.78						
33	M	WILD	WILD	01.04.74	09.07.81		TACOMA	USA	04.02.77	77021	0029	SSP	0	0	87 M
							TACOMA	USA NA	04.02.77						
34	M	WILD	WILD	01.04.74	12.03.87		TACOMA	USA	03.10.79	79046	0127	SSP	0	0	155 M
							TACOMA	USA NA	03.10.79						
35	F	WILD	WILD	01.04.74	02.07.84		TACOMA	USA	19.03.78	78028	0033	SSP	0	0	123 M
							TACOMA	USA NA	19.03.78						
36	F	WILD	WILD	01.04.74	04.03.79		DR. LONG	USA	27.04.77	77052	0036	SSP	0	0	59 M
							DR. LONG	USA NA	27.04.77						

RED WOLF (Canis rufus gregoryi)
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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # / Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
37	F	WILD	WILD	01.04.74	12.06.80		DR. LONG	USA	29.06.75	76058	0245	SSP	0	0	74 M
							DR. LONG	USA NA	29.06.75						
38	M	WILD	WILD	01.04.75	21.07.78		TACOMA	USA	07.01.78	77002	0026	SSP	0	0	40 M
							TACOMA	USA NA	07.01.78						
39	M	WILD	WILD	01.04.75	18.07.79		TACOMA	USA	27.04.77	77050	0034	SSP	0	0	52 M
							TACOMA	USA NA	27.04.77						
40	F	WILD	WILD	01.04.75	15.07.78		DR. LONG	USA	03.10.76	76133	0024	SSP	0	0	39 M
							DR. LONG	USA NA	03.10.76						
41	F	WILD	WILD	01.04.75	21.07.78		TACOMA	USA	06.01.77	77001	0025	SSP	0	0	40 M
							TACOMA	USA NA	06.01.77						
42	M	WILD	WILD	01.04.76	05.02.81		TACOMA	USA	06.04.78	78041	0040	SSP	0	0	58 M
							TACOMA	USA NA	06.04.78						
43	U	18	40	03.05.77	14.05.77		DR. LONG	USA	03.05.77		0239	SSP	59	25	11 D
							DR. LONG	USA NA	03.05.77						
44	M	18	40	03.05.77	01.08.78		DR. LONG	USA	03.05.77	77061	0240	SSP	59	25	15 F
							DR. LONG	USA NA	03.05.77						
45	F	18	40	03.05.77	03.05.78		DR. LONG	USA	03.05.77	77062	0241	SSP	59	25	12 M
							DR. LONG	USA NA	03.05.77						
46	U	18	40	03.05.77	03.05.78		DR. LONG	USA	03.05.77		0238	SSP	59	25	12 M
							DR. LONG	USA NA	03.05.77						
47	M	8	23	04.05.77	05.05.77		TACOMA	USA	04.05.77		0041	SSP	71	61	1 D
							TACOMA	USA NA	04.05.77						
48	F	8	23	04.05.77	12.02.83		TACOMA	USA	04.05.77	WG1	0043	SSP	71	61	69 M
							TACOMA	USA NA	04.05.77						
49	U	8	23	04.05.77	12.05.77		TACOMA	USA	04.05.77		0042	SSP	71	61	8 D
							TACOMA	USA NA	04.05.77						
50	M	6	12	13.05.77	17.05.77		TACOMA	USA	13.05.77		0044	SSP	83	73	4 D
							TACOMA	USA NA	13.05.77						
51	M	6	12	13.05.77	19.01.79		TACOMA	USA	13.05.77	WG3	0047	SSP	83	73	20 M
							TACOMA	USA NA	13.05.77						
52	M	6	12	13.05.77	22.12.89		TACOMA	USA	13.05.77	WG4	0048	SSP	83	73	151 M
							TACOMA	USA NA	13.05.77						
53	M	6	12	13.05.77	09.05.85		TACOMA	USA	13.05.77	WG5	0049	SSP	83	73	96 M
							AUDUBON	USA NA	30.10.80						
54	F	6	12	13.05.77	22.11.89		TACOMA	USA	13.05.77	WG2	0046	SSP	83	73	150 M
							WCSRC	USA NA	20.10.81						

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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
55	U	6	12	13.05.77	15.05.77		TACOMA	USA	13.05.77		0045	SSP	83	73	2 D
							TACOMA	USA NA	13.05.77						
56	M	2	14	16.05.77	21.07.78		TACOMA	USA	16.05.77	WG10	0054	SSP	120	74	14 M
							TACOMA	USA NA	16.05.77						
57	M	2	14	16.05.77	21.07.78		TACOMA	USA	16.05.77	WG11	0055	SSP	120	74	14 M
							TACOMA	USA NA	16.05.77						
58	F	2	14	16.05.77	21.07.78		TACOMA	USA	16.05.77	WG6	0050	SSP	120	74	14 M
							TACOMA	USA NA	16.05.77						
59	F	2	14	16.05.77	21.07.78		TACOMA	USA	16.05.77	WG7	0051	SSP	120	74	14 M
							TACOMA	USA NA	16.05.77						
60	F	2	14	16.05.77	21.07.78		TACOMA	USA	16.05.77	WG8	0052	SSP	120	74	14 M
							TACOMA	USA NA	16.05.77						
61	F	2	14	16.05.77	21.07.78		TACOMA	USA	16.05.77	WG9	0053	SSP	120	74	14 M
							TACOMA	USA NA	16.05.77						
62	M	3	7	23.05.77	01.05.79		TACOMA	USA	23.05.77	WG13	0057	SSP	108	86	23 M
							TACOMA	USA NA	23.05.77						
63	M	3	7	23.05.77	14.02.78		TACOMA	USA	23.05.77	WG14	0058	SSP	108	86	9 M
							TACOMA	USA NA	23.05.77						
64	F	3	7	23.05.77	21.07.78		TACOMA	USA	23.05.77	WG12	0056	SSP	108	86	14 M
							TACOMA	USA NA	23.05.77						
65	F	WILD	WILD	01.04.78	24.07.85		TACOMA	USA	23.03.80	80019	0246	SSP	0	0	88 M
							TACOMA	USA NA	23.03.80						
66	F	WILD	32	20.04.78	10.01.79		DR. LONG	USA	20.04.78	78074	0242	SSP	0	61	9 M
							DR. LONG	USA NA	20.04.78						
67	F	WILD	32	20.04.78	15.05.78		DR. LONG	USA	20.04.78		0243	SSP	0	61	25 D
							DR. LONG	USA NA	20.04.78						
68	M	28	40	25.04.78	15.01.79		DR. LONG	USA	25.04.78	78075	0073	SSP	59	37	9 M
							DR. LONG	USA NA	25.04.78						
69	U	28	40	25.04.78	25.05.78		DR. LONG	USA	25.04.78		0070	SSP	59	37	1 M
							DR. LONG	USA NA	25.04.78						
70	U	28	40	25.04.78	25.05.78		DR. LONG	USA	25.04.78		0071	SSP	59	37	1 M
							DR. LONG	USA NA	25.04.78						
71	U	28	40	25.04.78	25.05.78		DR. LONG	USA	25.04.78		0072	SSP	59	37	1 M
							DR. LONG	USA NA	25.04.78						
72	M	18	36	28.04.78	01.10.80		DR. LONG	USA	28.04.78	78077	0089	SSP	71	49	29 M
							DR. LONG	USA NA	28.04.78						

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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # / Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
73	F	18	36	28.04.78	23.04.80		DR. LONG	USA	28.04.78	78076	0088	SSP	71	49	24 M
							DR. LONG	USA NA	28.04.78						
74	U	18	36	28.04.78	01.05.78		DR. LONG	USA	28.04.78		0090	SSP	71	49	3 D
							DR. LONG	USA NA	28.04.78						
75	U	17	29	05.05.78	20.05.78		TACOMA	USA	05.05.78		0059	SSP	71	61	15 D
							TACOMA	USA NA	05.05.78						
76	U	17	29	05.05.78	23.05.78		TACOMA	USA	05.05.78		0060	SSP	71	61	18 D
							TACOMA	USA NA	05.05.78						
77	U	17	29	05.05.78	06.06.78		TACOMA	USA	05.05.78		0061	SSP	71	61	1 M
							TACOMA	USA NA	05.05.78						
78	U	17	29	05.05.78	14.06.78		TACOMA	USA	05.05.78		0062	SSP	71	61	1 M
							TACOMA	USA NA	05.05.78						
79	F	8	16	05.05.78	21.04.90		TACOMA	USA	05.05.78	WG17	0095	SSP	83	85	144 M
							TACOMA	USA NA	02.12.88						
80	U	8	16	05.05.78	06.05.78		TACOMA	USA	05.05.78		0091	SSP	83	85	1 D
							TACOMA	USA NA	05.05.78						
81	U	8	16	05.05.78	06.05.78		TACOMA	USA	05.05.78		0092	SSP	83	85	1 D
							TACOMA	USA NA	05.05.78						
82	U	8	16	05.05.78	06.05.78		TACOMA	USA	05.05.78		0093	SSP	83	85	1 D
							TACOMA	USA NA	05.05.78						
83	U	8	16	05.05.78	08.05.78		TACOMA	USA	05.05.78		0094	SSP	83	85	3 D
							TACOMA	USA NA	05.05.78						
84	M	33	15	10.05.78	01.05.84		TACOMA	USA	10.05.78	WG18	0081	SSP	47	85	72 M
							DR. LONG	USA NA	20.10.80						
85	M	33	15	10.05.78	09.08.79		TACOMA	USA	10.05.78	WG19	0082	SSP	47	85	15 M
							TACOMA	USA NA	10.05.78						
86	M	33	15	10.05.78	09.08.79		TACOMA	USA	10.05.78	WG20	0083	SSP	47	85	15 M
							TACOMA	USA NA	10.05.78						
87	F	33	15	10.05.78	27.02.79		TACOMA	USA	10.05.78	WG21	0084	SSP	47	85	10 M
							TACOMA	USA NA	10.05.78						
88	F	33	15	10.05.78	28.02.79		TACOMA	USA	10.05.78	WG22	0085	SSP	47	85	10 M
							TACOMA	USA NA	10.05.78						
89	F	33	15	10.05.78	09.08.79		TACOMA	USA	10.05.78	WG23	0086	SSP	47	85	15 M
							TACOMA	USA NA	10.05.78						
90	F	33	15	10.05.78	01.05.84		TACOMA	USA	10.05.78	WG24	0087	SSP	47	85	72 M
							DR. LONG	USA NA	20.10.80						

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RED WOLF (Canis rufus gregoryi)
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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
91	U	24	30	16.05.78	22.05.78		TACOMA	USA	16.05.78		0063	SSP	60	62	6 D
							TACOMA	USA NA	16.05.78						
92	U	24	30	16.05.78	22.05.78		TACOMA	USA	16.05.78		0064	SSP	60	62	6 D
							TACOMA	USA NA	16.05.78						
93	U	24	30	16.05.78	22.05.78		TACOMA	USA	16.05.78		0065	SSP	60	62	6 D
							TACOMA	USA NA	16.05.78						
94	F	6	12	16.05.78	05.04.82		TACOMA	USA	16.05.78	WG25	0101	SSP	96	86	47 M
							TACOMA	USA NA	16.05.78						
95	U	6	12	16.05.78	19.05.78		TACOMA	USA	16.05.78		0096	SSP	96	86	3 D
							TACOMA	USA NA	16.05.78						
96	U	6	12	16.05.78	19.05.78		TACOMA	USA	16.05.78		0097	SSP	96	86	3 D
							TACOMA	USA NA	16.05.78						
97	U	6	12	16.05.78	21.05.78		TACOMA	USA	16.05.78		0098	SSP	96	86	5 D
							TACOMA	USA NA	16.05.78						
98	U	6	12	16.05.78	22.05.78		TACOMA	USA	16.05.78		0099	SSP	96	86	6 D
							TACOMA	USA NA	16.05.78						
99	U	6	12	16.05.78	24.06.78		TACOMA	USA	16.05.78		0100	SSP	96	86	1 M
							TACOMA	USA NA	16.05.78						
100	M	3	7	18.05.78	07.11.78		TACOMA	USA	18.05.78	WG16	0080	SSP	120	98	6 M
							TACOMA	USA NA	18.05.78						
101	F	3	7	18.05.78	28.02.79		TACOMA	USA	18.05.78	WG15	0079	SSP	120	98	9 M
							TACOMA	USA NA	18.05.78						
102	U	3	7	18.05.78	18.06.78		TACOMA	USA	18.05.78		0074	SSP	120	98	1 M
							TACOMA	USA NA	18.05.78						
103	U	3	7	18.05.78	18.06.78		TACOMA	USA	18.05.78		0075	SSP	120	98	1 M
							TACOMA	USA NA	18.05.78						
104	U	3	7	18.05.78	18.06.78		TACOMA	USA	18.05.78		0076	SSP	120	98	1 M
							TACOMA	USA NA	18.05.78						
105	U	3	7	18.05.78	18.06.78		TACOMA	USA	18.05.78		0077	SSP	120	98	1 M
							TACOMA	USA NA	18.05.78						
106	U	3	7	18.05.78	18.06.78		TACOMA	USA	18.05.78		0078	SSP	120	98	1 M
							TACOMA	USA NA	18.05.78						
107	U	2	13	25.05.78	14.07.78		TACOMA	USA	25.05.78		0066	SSP	132	86	2 M
							TACOMA	USA NA	25.05.78						
108	U	2	13	25.05.78	14.07.78		TACOMA	USA	25.05.78		0067	SSP	132	86	2 M
							TACOMA	USA NA	25.05.78						

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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # / Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
109	U	2	13	25.05.78	14.07.78		TACOMA	USA	25.05.78		0068	SSP	132	86	2 M
							TACOMA	USA WA	25.05.78						
110	U	2	13	25.05.78	14.07.78		TACOMA	USA	25.05.78		0069	SSP	132	86	2 M
							TACOMA	USA WA	25.05.78						
111	F	33	14	28.04.79	. .		TACOMA	USA	28.04.79	WG30	0114	SSP	59	97	
							TACOMA	USA WA	28.04.79						
112	F	33	14	28.04.79	05.02.87		TACOMA	USA	28.04.79	WG31	0115	SSP	59	97	93 M
							VIC. TX	USA WA	22.03.83						
113	U	33	14	28.04.79	28.04.79		TACOMA	USA	28.04.79		0110	SSP	59	97	0 D
							TACOMA	USA WA	28.04.79						
114	U	33	14	28.04.79	28.04.79		TACOMA	USA	28.04.79		0111	SSP	59	97	0 D
							TACOMA	USA WA	28.04.79						
115	U	33	14	28.04.79	03.05.79		TACOMA	USA	28.04.79		0112	SSP	59	97	5 D
							TACOMA	USA WA	28.04.79						
116	U	33	14	28.04.79	03.05.79		TACOMA	USA	28.04.79		0113	SSP	59	97	5 D
							TACOMA	USA WA	28.04.79						
117	M	39	54	01.05.79	04.05.79		TACOMA	USA	01.05.79		0116	SSP	47	24	3 D
							TACOMA	USA WA	01.05.79						
118	M	39	54	01.05.79	15.11.81		TACOMA	USA	01.05.79	WG32	0117	SSP	47	24	30 M
							TACOMA	USA WA	01.05.79						
119	M	39	54	01.05.79	16.08.79		TACOMA	USA	01.05.79	WG33	0118	SSP	47	24	4 M
							TACOMA	USA WA	01.05.79						
120	F	39	54	01.05.79	08.08.79		TACOMA	USA	01.05.79	WG34	0119	SSP	47	24	3 M
							TACOMA	USA WA	01.05.79						
121	M	17	29	02.05.79	07.09.79		TACOMA	USA	02.05.79	WG35	0121	SSP	83	73	4 M
							TACOMA	USA WA	02.05.79						
122	F	17	29	02.05.79	08.05.79		TACOMA	USA	02.05.79		0120	SSP	83	73	6 D
							TACOMA	USA WA	02.05.79						
123	F	17	29	02.05.79	25.01.85		TACOMA	USA	02.05.79	WG36	0122	SSP	83	73	69 M
							TACOMA	USA WA	02.05.79						
124.	U	17	29	02.05.79	05.05.79		TACOMA	USA	02.05.79		0244	SSP	83	73	3 D
							TACOMA	USA WA	02.05.79						
125	U	8	15	08.05.79	10.05.79		TACOMA	USA	08.05.79		0102	SSP	95	97	2 D
							TACOMA	USA WA	08.05.79						
126	U	8	15	08.05.79	10.05.79		TACOMA	USA	08.05.79		0103	SSP	95	97	2 D
							TACOMA	USA WA	08.05.79						

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127	M	6	12	11.05.79	27.09.79		TACOMA	USA	11.05.79	WG26	0106	SSP	107	97	5 M
							TACOMA	USA WA	11.05.79						
128	M	6	12	11.05.79	04.11.80		TACOMA	USA	11.05.79	WG27	0107	SSP	107	97	18 M
							TACOMA	USA WA	11.05.79						
129	M	6	12	11.05.79	20.01.83		TACOMA	USA	11.05.79	WG28	0108	SSP	107	97	44 M
							TACOMA	USA WA	11.05.79						
130	F	6	12	11.05.79	18.05.79		TACOMA	USA	11.05.79		0104	SSP	107	97	7 D
							TACOMA	USA WA	11.05.79						
131	F	6	12	11.05.79	03.08.79		TACOMA	USA	11.05.79		0105	SSP	107	97	3 M
							TACOMA	USA WA	11.05.79						
132	F	6	12	11.05.79	. .		TACOMA	USA	11.05.79	WG29	0109	SSP	107	97	
							TACOMA	USA WA	09.01.91						
133	M	24	30	11.05.79	10.07.79		TACOMA	USA	11.05.79		0124	SSP	71	73	2 M
							TACOMA	USA WA	11.05.79						
134	M	24	30	11.05.79	30.07.79		TACOMA	USA	11.05.79		0125	SSP	71	73	3 M
							TACOMA	USA WA	11.05.79						
135	M	24	30	11.05.79	07.01.90		TACOMA	USA	11.05.79	WG37	0126	SSP	71	73	128 M
							TACOMA	USA WA	29.11.88						
136	U	24	30	11.05.79	14.05.79		TACOMA	USA	11.05.79		0123	SSP	71	73	3 D
							TACOMA	USA WA	11.05.79						
137	M	17	132	20.04.80	09.09.84		TACOMA	USA	20.04.80	WG39	0129	SSP	95	11	53 M
							VIC. TX	USA WA	22.03.83						
138	F	17	132	20.04.80	07.04.89		TACOMA	USA	20.04.80	WG38	0128	SSP	95	11	108 M
							TACOMA	USA WA	20.04.80						
139	M	11	54	27.04.80	04.12.83		TACOMA	USA	27.04.80	WG53	0152	SSP	107	35	43 M
							TACOMA	USA WA	27.04.80						
140	M	11	54	27.04.80	15.06.88		TACOMA	USA	27.04.80	WG54	0153	SSP	107	35	98 M
							N. CAROLINA	USA WA	12.11.86						
141	M	11	54	27.04.80	19.06.81		TACOMA	USA	27.04.80	WG55	0154	SSP	107	35	14 M
							TACOMA	USA WA	27.04.80						
142	F	11	54	27.04.80	13.02.91		TACOMA	USA	27.04.80	WG56	0155	SSP	107	35	130 M
							FOSSIL RIM	USA WA	07.02.89						
143	F	11	54	27.04.80	. .		TACOMA	USA	27.04.80	WG57	0156	SSP	107	35	
							LOS ANGELES	USA WA	12.02.89						
144	M	42	79	03.05.80	04.02.85		TACOMA	USA	03.05.80	WG62	0163	SSP	47	24	57 M
							TACOMA	USA WA	03.05.80						

RED WOLF (Canis rufus gregoryi)
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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # / Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
145	M	42	79	03.05.80	08.02.83		TACOMA	USA	03.05.80	WG63	0164	SSP	47	24	33 M
							TACOMA	USA NA	03.05.80						
146	M	42	79	03.05.80	19.04.88		TACOMA	USA	03.05.80	WG64	0165	SSP	47	24	96 M
							TACOMA	USA NA	22.01.87						
147	M	42	79	03.05.80	04.08.81		TACOMA	USA	03.05.80	WG65	0166	SSP	47	24	15 M
							TACOMA	USA NA	03.05.80						
148	M	42	79	03.05.80	05.05.80		TACOMA	USA	03.05.80		0167	SSP	47	24	2 D
							TACOMA	USA NA	03.05.80						
149	F	42	79	03.05.80	05.05.80		TACOMA	USA	03.05.80		0168	SSP	47	24	2 D
							TACOMA	USA NA	03.05.80						
150	M	53	14	05.05.80	07.05.80		TACOMA	USA	05.05.80		0150	SSP	34	109	2 D
							TACOMA	USA NA	05.05.80						
151	M	53	14	05.05.80	10.05.80		TACOMA	USA	05.05.80		0151	SSP	34	109	5 D
							TACOMA	USA NA	05.05.80						
152	F	53	14	05.05.80	26.01.84		TACOMA	USA	05.05.80	WG49	0144	SSP	34	109	45 L
							TACOMA	USA NA	05.05.80						
153	F	53	14	05.05.80	28.02.82		TACOMA	USA	05.05.80	WG50	0145	SSP	34	109	22 M
							TACOMA	USA NA	05.05.80						
154	F	53	14	05.05.80	26.07.80		TACOMA	USA	05.05.80	WG51	0146	SSP	34	109	3 M
							TACOMA	USA NA	05.05.80						
155	F	53	14	05.05.80	. .		TACOMA	USA	05.05.80	WG52	0147	SSP	34	109	
							TACOMA	USA NA	05.05.80						
156	F	53	14	05.05.80	16.05.80		TACOMA	USA	05.05.80		0148	SSP	34	109	11 D
							TACOMA	USA NA	05.05.80						
157	F	53	14	05.05.80	26.06.80		TACOMA	USA	05.05.80		0149	SSP	34	109	2 M
							TACOMA	USA NA	05.05.80						
158	M	24	35	05.05.80	04.08.81		TACOMA	USA	05.05.80	WG58	0157	SSP	83	73	15 M
							TACOMA	USA NA	05.05.80						
159	M	24	35	05.05.80	26.01.84		TACOMA	USA	05.05.80	WG59	0158	SSP	83	73	45 M
							TACOMA	USA NA	05.05.80						
160	M	24	35	05.05.80	08.05.80		TACOMA	USA	05.05.80		0162	SSP	83	73	3 D
							TACOMA	USA NA	05.05.80						
161	F	24	35	05.05.80	28.10.80		TACOMA	USA	05.05.80	WG60	0159	SSP	83	73	6 M
							TACOMA	USA NA	05.05.80						
162	F	24	35	05.05.80	29.04.81		TACOMA	USA	05.05.80	WG61	0160	SSP	83	73	12 M
							TACOMA	USA NA	05.05.80						

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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # / Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
163	F	24	35	05.05.80	08.05.80		TACOMA	USA	05.05.80		0161	SSP	83	73	3 D
							TACOMA	USA NA	05.05.80						
164	M	6	13	10.05.80	02.10.86		TACOMA	USA	10.05.80	WG47	0137	SSP	119	109	77 M
							TACOMA	USA NA	10.05.80						
165	M	6	13	10.05.80	. .		TACOMA	USA	10.05.80	WG48	0138	SSP	119	109	
							TACOMA	USA NA	10.05.80						
166	M	6	13	10.05.80	14.06.80		TACOMA	USA	10.05.80		0142	SSP	119	109	1 M
							TACOMA	USA NA	10.05.80						
167	M	6	13	10.05.80	18.06.80		TACOMA	USA	10.05.80		0143	SSP	119	109	1 M
							TACOMA	USA NA	10.05.80						
168	F	6	13	10.05.80	03.08.81		TACOMA	USA	10.05.80	WG46	0136	SSP	119	109	15 M
							TACOMA	USA NA	10.05.80						
169	F	6	13	10.05.80	13.05.80		TACOMA	USA	10.05.80		0139	SSP	119	109	3 D
							TACOMA	USA NA	10.05.80						
170	F	6	13	10.05.80	05.06.80		TACOMA	USA	10.05.80		0140	SSP	119	109	25 D
							TACOMA	USA NA	10.05.80						
171	F	6	13	10.05.80	10.06.80		TACOMA	USA	10.05.80		0141	SSP	119	109	1 M
							TACOMA	USA NA	10.05.80						
172	M	8	15	12.05.80	03.08.81		TACOMA	USA	12.05.80	WG43	0133	SSP	107	109	15 M
							TACOMA	USA NA	12.05.80						
173	M	8	15	12.05.80	04.08.81		TACOMA	USA	12.05.80	WG44	0134	SSP	107	109	15 M
							TACOMA	USA NA	12.05.80						
174	M	8	15	12.05.80	04.08.81		TACOMA	USA	12.05.80	WG45	0135	SSP	107	109	15 M
							TACOMA	USA NA	12.05.80						
175	F	8	15	12.05.80	03.08.81		TACOMA	USA	12.05.80	WG40	0130	SSP	107	109	15 M
							TACOMA	USA NA	12.05.80						
176	F	8	15	12.05.80	03.08.81		TACOMA	USA	12.05.80	WG41	0131	SSP	107	109	15 M
							TACOMA	USA NA	12.05.80						
177	F	8	15	12.05.80	25.07.80		TACOMA	USA	12.05.80	WG42	0132	SSP	107	109	2 M
							TACOMA	USA NA	12.05.80						
178	M	24	152	23.04.81	25.04.81		TACOMA	USA	23.04.81		0188	SSP	95	12	2 D
							TACOMA	USA NA	23.04.81						
179	M	24	152	23.04.81	. .		TACOMA	USA	23.04.81	WG74	0189	SSP	95	12	
							BATON ROUGE	USA NA	01.02.90						
180	M	24	152	23.04.81	. .		TACOMA	USA	23.04.81	WG75	0190	SSP	95	12	
							FOSSIL RIM	USA NA	07.02.89						

RED WOLF (Canis rufus gregoryi)
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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
181	F	24	152	23.04.81	15.02.82		TACOMA	USA	23.04.81	WG76	0191	SSP	95	12	10 M
							TACOMA	USA WA	23.04.81						
182	F	24	152	23.04.81	23.04.81		TACOMA	USA	23.04.81		0192	SSP	95	12	0 D
							TACOMA	USA WA	23.04.81						
183	F	24	152	23.04.81	28.06.81		TACOMA	USA	23.04.81		0193	SSP	95	12	2 M
							TACOMA	USA WA	23.04.81						
184	M	34	132	01.05.81	29.05.88		TACOMA	USA	01.05.81	WG66	0169	SSP	83	24	85 M
							N. CAROLINA	USA WA	12.11.86						
185	F	34	132	01.05.81	23.01.82		TACOMA	USA	01.05.81	WG67	0170	SSP	83	24	9 M
							TACOMA	USA WA	01.05.81						
186	F	34	132	01.05.81	01.05.81		TACOMA	USA	01.05.81		0171	SSP	83	24	0 D
							TACOMA	USA WA	01.05.81						
187	M	8	13	01.05.81	01.05.81		TACOMA	USA	01.05.81		0174	SSP	119	121	0 D
							TACOMA	USA WA	01.05.81						
188	M	8	13	01.05.81	01.05.81		TACOMA	USA	01.05.81		0175	SSP	119	121	0 D
							TACOMA	USA WA	01.05.81						
189	M	8	13	01.05.81	01.05.81		TACOMA	USA	01.05.81		0176	SSP	119	121	0 D
							TACOMA	USA WA	01.05.81						
190	F	8	13	01.05.81	01.05.81		TACOMA	USA	01.05.81		0177	SSP	119	121	0 D
							TACOMA	USA WA	01.05.81						
191	F	8	13	01.05.81	01.05.81		TACOMA	USA	01.05.81		0178	SSP	119	121	0 D
							TACOMA	USA WA	01.05.81						
192	F	8	13	01.05.81	01.05.81		TACOMA	USA	01.05.81		0179	SSP	119	121	0 D
							TACOMA	USA WA	01.05.81						
193	F	8	13	01.05.81	01.05.81		TACOMA	USA	01.05.81		0180	SSP	119	121	0 D
							TACOMA	USA WA	01.05.81						
194	F	8	13	01.05.81	28.12.87		TACOMA	USA	01.05.81	WG69	0181	SSP	119	121	80 M
							N. CAROLINA	USA WA	12.11.86						
195	F	8	13	01.05.81	. .		TACOMA	USA	01.05.81	WG70	0182	SSP	119	121	
							TACOMA	USA WA	01.05.81						
196	F	26	54	01.05.81	25.05.88		TACOMA	USA	01.05.81	WG72	0186	SSP	47	48	85 M
							N. CAROLINA	USA WA	12.11.86						
197	F	26	54	01.05.81	25.08.81		TACOMA	USA	01.05.81	WG73	0187	SSP	47	48	4 M
							TACOMA	USA WA	01.05.81						
198	M	11	15	18.05.81	26.05.81		TACOMA	USA	18.05.81		0172	SSP	120	122	8 D
							TACOMA	USA WA	18.05.81						

RED WOLF (Canis rufus gregoryi)
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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
199	F	11	15	18.05.81	06.09.81		TACOMA	USA	18.05.81	WG68	0173	SSP	120	122	4 M
							TACOMA	USA NA	18.05.81						
200	M	6	65	25.05.81	23.06.81		TACOMA	USA	25.05.81		0183	SSP	132	38	28 D
							TACOMA	USA NA	25.05.81						
201	F	6	65	25.05.81	25.05.81		TACOMA	USA	25.05.81		0184	SSP	132	38	0 D
							TACOMA	USA NA	25.05.81						
202	F	6	65	25.05.81	02.07.84		TACOMA	USA	25.05.81	WG71	0185	SSP	132	38	37 M
							TACOMA	USA NA	25.05.81						
203	M	11	54	23.04.82	01.11.82		WCSRC	USA	23.04.82	WG80	0208	SSP	131	59	6 M
							WCSRC	USA NA	23.04.82						
204	M	11	54	23.04.82	25.04.82		WCSRC	USA	23.04.82		0209	SSP	131	59	2 D
							WCSRC	USA NA	23.04.82						
205	F	11	54	23.04.82	. .		WCSRC	USA	23.04.82	WG77	0205	SSP	131	59	
							N. CAROLINA	USA NA	12.11.86						
206	F	11	54	23.04.82	04.08.87		WCSRC	USA	23.04.82	WG78	0206	SSP	131	59	63 M
							TACOMA	USA NA	23.07.87						
207	F	11	54	23.04.82	01.11.82		WCSRC	USA	23.04.82	WG79	0207	SSP	131	59	6 M
							WCSRC	USA NA	23.04.82						
208	M	52	132	29.04.82	30.07.89	.250	TACOMA	USA	29.04.82	WG83	0195	SSP	58	36	87 M
							N. CAROLINA	USA NA	11.01.89						
209	M	52	132	29.04.82	12.07.82	.250	TACOMA	USA	29.04.82		0196	SSP	58	36	2 M
							TACOMA	USA NA	29.04.82						
210	F	52	132	29.04.82	29.01.83	.250	TACOMA	USA	29.04.82	WG82	0194	SSP	58	36	9 M
							TACOMA	USA NA	29.04.82						
211	M	24	112	29.04.82	27.12.88		TACOMA	USA	29.04.82	WG84	0197	SSP	107	36	80 M
							N. CAROLINA	USA NA	12.11.86						
212	M	24	112	29.04.82	. .		TACOMA	USA	29.04.82	WG85	0198	SSP	107	36	
							TACOMA	USA NA	29.04.82						
213	M	24	112	29.04.82	27.09.88		TACOMA	USA	29.04.82	WG86	0199	SSP	107	36	77 M
							N. CAROLINA	USA NA	22.01.88						
214	F	24	112	29.04.82	07.07.82		TACOMA	USA	29.04.82		0200	SSP	107	36	2 M
							TACOMA	USA NA	29.04.82						
215	F	24	112	29.04.82	. .		TACOMA	USA	29.04.82	WG87	0201	SSP	107	36	
							TACOMA	USA NA	22.02.89						
216	F	24	112	29.04.82	21.08.88		TACOMA	USA	29.04.82	WG88	0202	SSP	107	36	76 M
							ALEX	USA NA	15.12.83						

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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
217	F	24	112	29.04.82	20.08.82		TACOMA	USA	29.04.82	WG89	0203	SSP	109	36	4 M
							TACOMA	USA NA	29.04.82						
218	F	24	112	29.04.82	03.09.85		TACOMA	USA	29.04.82	WG90	0204	SSP	107	36	40 M
							TACOMA	USA NA	29.04.82						
219	M	53	79	19.04.83	. .		AUDUBON	USA	19.04.83	LF106	0234	SSP	69	59	
							SMOKIES	USA NA	28.01.91						
220	F	53	79	19.04.83	30.08.83		AUDUBON	USA	19.04.83	LF107	0235	SSP	69	59	4 M
							AUDUBON	USA NA	19.04.83						
221	F	53	79	19.04.83	. .		AUDUBON	USA	19.04.83	LF108	0236	SSP	69	59	
							TACOMA	USA NA	20.11.84						
222	F	53	79	19.04.83	. .		AUDUBON	USA	19.04.83	LF109	0237	SSP	69	59	
							TACOMA	USA NA	07.12.88						
223	U	53	79	19.04.83	24.04.83		AUDUBON	USA	19.04.83	LF105	0233	SSP	69	59	5 D
							AUDUBON	USA NA	19.04.83						
224	M	11	54	23.04.83	. .		WCSRC	USA	23.04.83	WG92	0211	SSP	143	71	
							TACOMA	USA NA	05.12.89						
225	M	11	54	23.04.83	. .		WCSRC	USA	23.04.83	WG93	0212	SSP	143	71	
							TACOMA	USA NA	16.01.91						
226	U	11	54	23.04.83	28.04.83		WCSRC	USA	23.04.83	WG91	0210	SSP	143	71	5 D
							WCSRC	USA NA	23.04.83						
227	M	164	196	23.04.83	03.09.89	.063	TACOMA	USA	23.04.83	WG94	0213	SSP	33	24	76 M
							N. CAROLINA	USA NA	12.11.86						
228	M	164	196	23.04.83	01.05.83	.063	TACOMA	USA	23.04.83		0214	SSP	33	24	8 D
							TACOMA	USA NA	23.04.83						
229	F	164	196	23.04.83	02.05.83	.063	TACOMA	USA	23.04.83		0215	SSP	33	24	9 D
							TACOMA	USA NA	23.04.83						
230	F	146	152	08.05.83	15.10.88		TACOMA	USA	08.05.83	WG95	0216	SSP	34	36	65 M
							VIC. TX	USA NA	10.02.87						
231	F	146	152	08.05.83	18.12.87		TACOMA	USA	08.08.83	WG96	0217	SSP	34	36	55 M
							N. CAROLINA	USA NA	12.11.86						
232	F	146	152	08.05.83	10.03.84		TACOMA	USA	08.05.83	WG97	0218	SSP	34	36	10 M
							TACOMA	USA NA	08.05.83						
233	F	146	152	08.05.83	11.01.91		TACOMA	USA	08.05.83	WG98	0219	SSP	34	36	92 M
							VIC. TX	USA NA	08.01.91						
234	M	140	35	10.05.83	28.11.84		TACOMA	USA	10.05.83	WG99	0220	SSP	34	109	19 M
							TACOMA	USA NA	10.05.83						

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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
235	M	140	35	10.05.83	23.05.83		TACOMA	USA	10.05.83		0221	SSP	34	109	13 D
							TACOMA	USA WA	10.05.83						
236	M	140	35	10.05.83	23.05.83		TACOMA	USA	10.05.83		0222	SSP	34	109	13 D
							TACOMA	USA WA	10.05.83						
237	M	140	35	10.05.83	10.06.83		TACOMA	USA	10.05.83		0223	SSP	34	109	1 M
							TACOMA	USA WA	10.05.83						
238	F	140	35	10.05.83	24.07.84		TACOMA	USA	10.05.83	WG100	0224	SSP	34	109	14 M
							TACOMA	USA WA	10.05.83						
239	F	140	35	10.05.83	16.05.83		TACOMA	USA	10.05.83		0225	SSP	34	109	6 D
							TACOMA	USA WA	10.05.83						
240	F	140	35	10.05.83	31.05.83		TACOMA	USA	10.05.83		0226	SSP	34	109	21 D
							TACOMA	USA WA	10.05.83						
241	F	140	35	10.05.83	23.06.83		TACOMA	USA	10.05.83		0227	SSP	34	109	1 M
							TACOMA	USA WA	10.05.83						
242	M	52	195	13.05.83	04.11.89		TACOMA	USA	13.05.83	WG104	0232	SSP	70	24	78 M
							S. CAROLINA	USA WA	19.11.87						
243	F	52	195	13.05.83	. .		TACOMA	USA	13.05.83	WG101	0228	SSP	70	24	
							TALLAHASSE	USA WA	15.01.91						
244	F	52	195	13.05.83	14.07.86		TACOMA	USA	13.05.83	WG102	0229	SSP	70	24	38 M
							G.B. FL	USA WA	25.04.84						
245	F	52	195	13.05.83	27.09.89		TACOMA	USA	13.05.83	WG103	0230	SSP	70	24	76 M
							MISSISSIPPI	USA WA	10.01.89						
246	F	52	195	13.05.83	14.05.83		TACOMA	USA	13.05.83		0231	SSP	70	24	1 D
							TACOMA	USA WA	13.05.83						
247	M	11	54	19.04.84	. .		WCSRC	USA	19.04.84	LM110	0247	SSP	155	83	
							TACOMA	USA WA	21.07.89						
248	F	11	54	19.04.84	. .		WCSRC	USA	19.04.84	LM111	0248	SSP	155	83	
							KNOXVILLE	USA WA	17.01.91						
249	M	11	54	19.04.84	28.04.84		WCSRC	USA	19.04.84		0249	SSP	155	83	9 D
							WCSRC	USA WA	19.04.84						
250	F	11	54	19.04.84	28.04.84		WCSRC	USA	19.04.84		0250	SSP	155	83	9 D
							WCSRC	USA WA	19.04.84						
251	F	146	216	21.04.84	. .		ALEX	USA	21.04.84	GL112	0251	SSP	46	24	
							TACOMA	USA WA	15.01.91						
252	F	146	216	21.04.84	09.05.90		ALEX	USA	21.04.84	GL113	0252	SSP	46	24	73 M
							FOSSIL RIM	USA WA	07.02.89						

RED WOLF (Canis rufus gregoryi)
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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # / Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
253	F	146	216	21.04.84	. .		ALEX	USA	21.04.84	GL114	0253	SSP	46	24	
							TACOMA	USA WA	13.12.90						
254	F	146	216	21.04.84	08.01.89		ALEX	USA	21.04.84	GL115	0254	SSP	46	24	57 M
							ALEX	USA WA	21.04.84						
255	M	137	112	23.04.84	. .		VIC. TX	USA	23.04.84	UH116	0255	SSP	46	60	
							TACOMA	USA WA	08.11.85						
256	M	137	112	23.04.84	99.99.99		VIC. TX	USA	23.04.84	UH117	0256	SSP	46	60	?
							VIC. TX	USA WA	23.04.84						
257	M	137	112	23.04.84	26.06.84		VIC. TX	USA	23.04.84		0257	SSP	46	60	2 M
							VIC. TX	USA WA	23.04.84						
258	F	137	112	23.04.84	26.06.84		VIC. TX	USA	23.04.84		0258	SSP	46	60	2 M
							VIC. TX	USA WA	23.04.84						
259	F	137	112	23.04.84	26.06.84		VIC. TX	USA	23.04.84		0259	SSP	46	60	2 M
							VIC. TX	USA WA	23.04.84						
260	F	137	112	23.04.84	26.06.84		VIC. TX	USA	23.04.84		0260	SSP	46	60	2 M
							VIC. TX	USA WA	23.04.84						
261	M	144	65	18.05.84	24.07.85		TACOMA	USA	18.05.84	WG118	0261	SSP	47	74	14 M
							TACOMA	USA WA	18.05.84						
262	M	144	65	18.05.84	24.07.85		TACOMA	USA	18.05.84	WG119	0262	SPP	47	74	14 M
							TACOMA	USA WA	18.05.84						
263	M	144	65	18.05.84	24.07.85		TACOMA	USA	18.05.84	WG120	0263	SSP	47	74	14 M
							TACOMA	USA WA	18.05.84						
264	F	144	65	18.05.84	24.07.85		TACOMA	USA	18.05.84	WG121	0264	SSP	47	74	14 M
							TACOMA	USA WA	18.05.84						
265	F	144	65	18.05.84	24.07.85		TACOMA	USA	18.05.84	WG122	0265	SSP	47	74	14 M
							TACOMA	USA WA	18.05.84						
266	F	144	65	18.05.84	24.07.85		TACOMA	USA	18.05.84	WG123	0266	SSP	47	74	14 M
							TACOMA	USA WA	18.05.84						
267	M	53	79	23.04.85	23.04.85		AUDUBON	USA	23.04.85		0267	SSP	93	84	0 D
							AUDUBON	USA WA	23.04.85						
268	M	53	79	23.04.85	. .		AUDUBON	USA	23.04.85	LF268	0268	SSP	93	84	
							TACOMA	USA WA	15.01.91						
269	F	53	79	23.04.85	. .		AUDUBON	USA	23.04.85	LF269	0269	SSP	93	84	
							TACOMA	USA WA	20.01.89						
270	F	53	79	23.04.85	. .		AUDUBON	USA	23.04.85	LF270	0270	SSP	93	84	
							AUDUBON	USA WA	23.04.85						

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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
271	F	53	79	23.04.85	23.04.85		AUDUBON	USA	23.04.85		0271	SSP	93	84	0 D
							AUDUBON	USA NA	23.04.85						
272	M	11	54	03.05.85	. .		WCSRC	USA	03.05.85	LM272	0272	SSP	167	96	
							TACOMA	USA NA	13.12.90						
273	M	11	54	03.05.85	08.05.85		WCSRC	USA	03.05.85		0273	SSP	167	96	5 D
							WCSRC	USA NA	03.05.85						
274	F	11	54	03.05.85	08.05.85		WCSRC	USA	03.05.85		0274	SSP	167	96	5 D
							WCSRC	USA NA	03.05.85						
275	F	11	54	03.05.85	08.05.85		WCSRC	USA	03.05.85		0275	SSP	167	96	5 D
							WCSRC	USA NA	03.05.85						
276	F	11	54	03.05.85	08.05.85		WCSRC	USA	03.05.85		0276	SSP	167	96	5 D
							WCSRC	USA NA	03.05.85						
277	F	34	132	06.05.85	. .		TACOMA	USA	06.05.85	WG277	0277	SSP	131	72	
							NATIONAL ZOO	USA NA	19.09.90						
278	F	34	132	06.05.85	. .		TACOMA	USA	06.05.85	WG278	0278	SSP	131	72	
							VIC. TX	USA NA	17.01.91						
279	F	34	132	06.05.85	29.07.88		TACOMA	USA	06.05.85	WG279	0279	SSP	131	72	39 M
							S. CAROLINA	USA NA	19.11.87						
280	M	213	244	07.05.85	. .		G.B. FL	USA	07.05.85	TZ280	0280	SSP	34	24	
							N. CAROLINA	USA NA	05.01.90						
281	M	213	244	07.05.85	14.07.86		G.B. FL	USA	07.05.85	TZ281	0281	SSP	34	24	14 M
							G.B. FL	USA NA	07.05.85						
282	M	213	244	07.05.85	. .		G.B. FL	USA	07.05.85	TZ282	0282	SSP	34	24	
							OGLEBAY	USA NA	28.12.88						
283	F	213	244	07.05.85	12.09.85		G.B. FL	USA	07.05.85		0283	SSP	34	24	4 M
							G.B. FL	USA NA	07.05.85						
284	M	11	54	21.04.86	15.08.86		WCSRC	USA	21.04.86	LM284	0284	SSP	179	107	4 M
							WCSRC	USA NA	21.04.86						
285	F	11	54	21.04.86	29.04.86		WCSRC	USA	21.04.86		0285	SSP	179	107	8 D
							WCSRC	USA NA	21.04.86						
286	F	11	54	21.04.86	07.05.86		WCSRC	USA	21.04.86		0286	SSP	179	107	16 D
							WCSRC	USA NA	21.04.86						
287	F	11	54	21.04.86	15.08.86		WCSRC	USA	21.04.86	LM287	0287	SSP	179	107	4 M
							WCSRC	USA NA	21.04.86						
288	F	11	54	21.04.86	27.10.86		WCSRC	USA	21.04.86	LM288	0288	SSP	179	107	6 M
							WCSRC	USA NA	21.04.86						

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RED WOLF (Canis rufus gregoryi)
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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # / Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
289	F	213	244	28.04.86	19.08.89		G.B. FL	USA	28.04.86	TZ289	0289	SSP	46	36	40 M
							S. CAROLINA	USA NA	22.11.88						
290	F	213	244	28.04.86	11.12.86		G.B. FL	USA	28.04.86	TZ290	0290	SSP	46	36	7 M
							TACOMA	USA NA	25.09.86						
291	M	213	244	28.04.86	. .		G.B. FL	USA	28.04.86	TZ291	0291	SSP	46	36	
							LOS ANGELES	USA NA	20.12.90						
292	M	213	244	28.04.86	. .		G.B. FL	USA	28.04.86	TZ292	0292	SSP	46	36	
							LOS ANGELES	USA NA	12.02.89						
293	M	213	244	28.04.86	. .		G.B. FL	USA	28.04.86	TZ293	0293	SSP	46	36	
							VIC. TX	USA NA	30.11.88						
294	M	24	196	29.04.86	. .		TACOMA	USA	29.04.86	WG294	0294	SSP	155	60	
							TACOMA	USA NA	05.12.89						
295	M	24	196	29.04.86	02.10.86		TACOMA	USA	29.04.86	WG295	0295	SSP	155	60	5 M
							TACOMA	USA NA	29.04.86						
296	F	24	196	29.04.86	23.12.86		TACOMA	USA	29.04.86	WG296	0296	SSP	155	60	8 M
							TACOMA	USA NA	29.04.86						
297	F	24	196	29.04.86	. .		TACOMA	USA	29.04.86	WG297	0297	SSP	155	60	
							FRESNO ZOO	USA NA	07.01.91						
298	F	24	196	29.04.86	06.07.86		TACOMA	USA	29.04.86	WG298	0298	SSP	155	60	2 M
							TACOMA	USA NA	29.04.86						
299	M	227	194	06.05.86	. .	.063	TACOMA	USA	06.05.86	WG299	0299	SSP	34	60	
							KNOXVILLE	USA NA	17.01.91						
300	F	227	194	06.05.86	. .	.063	TACOMA	USA	06.05.86	WG300	0300	SSP	34	60	
							N. CAROLINA	USA NA	22.01.88						
301	F	227	194	06.05.86	. .	.063	TACOMA	USA	06.05.86	WG301	0301	SSP	34	60	
							TACOMA	USA NA	19.12.89						
302	F	227	194	06.05.86	. .	.063	TACOMA	USA	06.05.86	WG302	0302	SSP	34	60	
							FOSSIL RIM	USA NA	06.12.90						
303	F	227	194	06.05.86	. .	.063	TACOMA	USA	06.05.86	WG303	0303	SSP	34	60	
							SMOKIES	USA NA	28.01.91						
304	F	227	194	06.05.86	. .	.063	TACOMA	USA	06.05.86	WG304	0304	SSP	34	60	
							N. CAROLINA	USA NA	09.10.90						
305	F	227	194	06.05.86	. .	.063	TACOMA	USA	06.05.86	WG305	0305	SSP	34	60	
							WCSRC	USA NA	06.12.88						
306	F	227	194	06.05.86	14.07.86	.063	TACOMA	USA	06.05.86	WG306	0306	SSP	34	60	2 M
							TACOMA	USA NA	06.05.86						

RED WOLF (Canis rufus gregoryi)
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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # / Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
307	M	247	54	18.04.87	28.04.87	.250	WCSRC	USA	18.04.87		0307	SSP	34	119	10 D
							WCSRC	USA NA	18.04.87						
308	U	247	54	18.04.87	27.04.87	.250	WCSRC	USA	18.04.87		0308	SSP	34	119	9 D
							WCSRC	USA NA	18.04.87						
309	U	247	54	18.04.87	27.04.87	.250	WCSRC	USA	18.04.87		0309	SSP	34	119	9 D
							WCSRC	USA NA	18.04.87						
310	M	227	194	25.04.87	28.04.87	.063	N. CAROLINA	USA	25.04.87		0310	SSP	46	72	3 D
							N. CAROLINA	USA NA	25.04.87						
311	M	242	279	26.04.87	21.08.87	.063	TACOMA	USA	26.04.87	WG311	0311	SSP	45	24	4 M
							TACOMA	USA NA	26.04.87						
312	M	242	279	26.04.87	. .	.063	TACOMA	USA	26.04.87	WG312	0312	SSP	45	24	
							WCSRC	USA NA	25.01.91						
313	F	242	279	26.04.87	. .	.063	TACOMA	USA	26.04.87	WG313	0313	SSP	45	24	
							N. CAROLINA	USA NA	22.01.88						
14	F	242	279	26.04.87	08.02.88	.063	TACOMA	USA	26.04.87	WG314	0314	SSP	45	24	9 M
							TACOMA	USA NA	26.04.87						
315	F	242	279	26.04.87	. .	.063	TACOMA	USA	26.04.87	WG315	0315	SSP	45	24	
							BATON ROUGE	USA NA	06.12.88						
316	F	242	279	26.04.87	. .	.063	TACOMA	USA	26.04.87	WG316	0316	SSP	45	24	
							N. CAROLINA	USA NA	22.01.88						
317	M	52	142	26.04.87	11.08.87	.125	TACOMA	USA	26.04.87	WG317	0317	SSP	117	84	4 M
							TACOMA	USA NA	26.04.87						
318	M	52	142	26.04.87	11.08.87	.125	TACOMA	USA	26.04.87	WG318	0318	SSP	117	84	4 M
							TACOMA	USA NA	26.04.87						
319	M	52	142	26.04.87	. .	.125	TACOMA	USA	26.04.87	WG319	0319	SSP	117	84	
							N. CAROLINA	USA NA	22.01.88						
320	F	179	245	12.05.87	13.08.87	.031	TACOMA	USA	12.05.87	WG320	0320	SSP	71	48	3 M
							TACOMA	USA NA	12.05.87						
321	F	179	245	12.05.87	. .	.031	TACOMA	USA	12.05.87	WG321	0321	SSP	71	48	
							TACOMA	USA NA	12.05.87						
322	F	179	245	12.05.87	. .	.031	TACOMA	USA	12.05.87	WG322	0322	SSP	71	48	
							TACOMA	USA NA	13.12.90						
323	F	179	245	12.05.87	. .	.031	TACOMA	USA	12.05.87	WG323	0323	SSP	71	48	
							LBL	USA NA	28.01.91						
324	F	179	245	12.05.87	. .	.031	TACOMA	USA	12.05.87	WG324	0324	SSP	71	48	
							BEARDSLEY ZO	USA NA	28.01.91						

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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # / Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
325	F	179	245	12.05.87	. .	.031	TACOMA	USA	12.05.87	WG325	0325	SSP	71	48	
							TACOMA	USA NA	12.05.87						
326	F	179	245	12.05.87	16.08.87	.031	TACOMA	USA	12.05.87	WG326	0326	SSP	71	48	3 M
							TACOMA	USA NA	12.05.87						
327	M	179	245	12.05.87	20.09.90	.031	TACOMA	USA	12.05.87	WG327	0327	SSP	71	48	40 M
							DURANT IS.	USA NA	12.07.90						
328	M	179	245	12.05.87	. .	.031	TACOMA	USA	12.05.87	WG328	0328	SSP	71	48	
							N. CAROLINA	USA NA	22.01.88						
329	M	242	279	21.04.88	25.04.88	.063	S. CAROLINA	USA	21.04.88	FWS329	0329	SSP	59	36	4 D
							S. CAROLINA	USA NA	21.04.88						
330	F	242	279	21.04.88	14.06.88	.063	S. CAROLINA	USA	21.04.88	FWS330	0330	SSP	59	36	2 M
							S. CAROLINA	USA NA	21.04.88						
331	M	242	279	21.04.88	. .	.063	S. CAROLINA	USA	21.04.88	FWS331	0331	SSP	59	36	
							N. CAROLINA	USA NA	18.01.89						
332	M	242	279	21.04.88	22.11.89	.063	S. CAROLINA	USA	21.04.88	FWS332	0332	SSP	59	36	19 [illegible]
							N. CAROLINA	USA NA	18.01.89						
333	M	213	245	05.05.88	10.05.88		N. CAROLINA	USA	05.05.88	FWS333	0333	SSP	72	60	5 D
							N. CAROLINA	USA NA	05.05.88						
334	M	213	245	05.05.88	25.05.88		N. CAROLINA	USA	05.05.88	FWS334	0334	SSP	72	60	20 D
							N. CAROLINA	USA NA	05.05.88						
335	M	213	245	05.05.88	. .		N. CAROLINA	USA	05.05.88	FWS335	0335	SSP	72	60	
							NATIONAL ZOO	USA NA	19.09.90						
336	M	213	245	05.05.88	. .		N. CAROLINA	USA	05.05.88	FWS336	0336	SSP	72	60	
							TACOMA	USA NA	23.08.90						
337	F	213	245	05.05.88	. .		N. CAROLINA	USA	05.05.88	FWS337	0337	SSP	72	60	
							N. CAROLINA	USA NA	05.05.88						
338	F	213	245	05.05.88	. .		N. CAROLINA	USA	05.05.88	FWS338	0338	SSP	72	60	
							ALEX	USA NA	12.12.90						
339	F	213	245	05.05.88	27.11.90		N. CAROLINA	USA	05.05.88	FWS339	0339	SSP	72	60	31 M
							TACOMA	USA NA	08.12.88						
340	M	268	215	18.05.88	26.07.88		BURNET	USA	18.05.88	LV340	0340	SSP	37	73	2 M
							BURNET	USA NA	18.05.88						
341	M	268	215	18.05.88	. .		BURNET	USA	18.05.88	LV341	0341	SSP	37	73	
							SMOKIES	USA NA	15.01.91						
342	F	268	215	18.05.88	. .		BURNET	USA	18.05.88	LV342	0342	SSP	37	73	
							LOWRY PK ZOO	USA NA	05.12.90						

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343	F	268	215	18.05.88	29.07.88		BURNET	USA	18.05.88	LV343	0343	SSP	37	73	2 M
							BURNET	USA NA	18.05.88						
344	F	211	196	05.05.88	. .		N. CAROLINA	USA	05.05.88	FWS344	0344	SSP	72	84	
							N. CAROLINA	USA NA	05.05.88						
345	M	291	289	10.05.88	03.07.88	.250	TACOMA	USA	10.05.88	WG345	0345	SSP	22	24	2 M
							TACOMA	USA NA	10.05.88						
346	M	291	289	10.05.88	10.10.89	.250	TACOMA	USA	10.05.88	WG346	0346	SSP	22	24	17 M
							TACOMA	USA NA	10.05.88						
347	F	280	269	03.05.88	. .	.047	AUDUBON	USA	03.05.88	LF347	0347	SSP	34	36	
							TACOMA	USA NA	20.01.89						
348	F	280	269	03.05.88	. .	.047	AUDUBON	USA	03.05.88	LF348	0348	SSP	34	36	
							ROGER WILLIA	USA NA	07.01.91						
349	M	280	269	03.05.88	. .	.047	AUDUBON	USA	03.05.88	LF349	0349	SSP	34	36	
							LBL	USA NA	30.01.91						
350	M	280	269	03.05.88	. .	.047	AUDUBON	USA	03.05.88	LF350	0350	SSP	34	36	
							FRESNO ZOO	USA NA	18.09.89						
351	F	184	205	28.04.88	27.01.91	.063	N. CAROLINA	USA	28.04.88	FWS351	0351	SSP	82	72	33 M
							N. CAROLINA	USA NA	28.04.88						
352	M	219	303	15.04.89	. .	.063	TALLAHASSE	USA	15.04.89	352	0352	SSP	70	35	
							N. CAROLINA	USA NA	06.12.90						
353	M	219	303	15.04.89	. .	.063	TALLAHASSE	USA	15.04.89	353	0353	SSP	70	35	
							ROSS PARK	USA NA	05.09.90						
354	M	219	303	15.04.89	. .	.063	TALLAHASSE	USA	15.04.89	354	0354	SSP	70	35	
							TALLAHASSE	USA NA	15.04.89						
355	M	293	301	29.04.89	29.04.89	.055	VIC. TX	USA	29.04.89	UH355	0355	SSP	34	36	0 D
							VIC. TX	USA NA	29.04.89						
356	M	293	301	29.04.89	. .	.055	VIC. TX	USA	29.04.89	UH356	0356	SSP	34	36	
							AUDUBON	USA NA	19.12.89						
357	M	293	301	29.04.89	. .	.055	VIC. TX	USA	29.04.89	UH357	0357	SSP	34	36	
							TACOMA	USA NA	19.12.89						
358	M	293	301	29.04.89	. .	.055	VIC. TX	USA	29.04.89	UH358	0358	SSP	34	36	
							MISSISSIPPI	USA NA	16.01.91						
359	M	293	301	29.04.89	. .	.055	VIC. TX	USA	29.04.89	UH359	0359	SSP	34	36	
							LOWRY PK ZOO	USA NA	03.01.90						
360	F	293	301	29.04.89	. .	.055	VIC. TX	USA	29.04.89	UH360	0360	SSP	34	36	
							TACOMA	USA NA	19.12.89						

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361	F	293	301	29.04.89	22.11.90	.055	VIC. TX	USA	29.04.89	UH361	0361	SSP	34	36	19 M
							LOWRY PK ZOO	USA NA	03.01.90						
362	M	268	277	02.05.89	04.08.89	.063	BURNET	USA	02.05.89	LV362	0362	SSP	46	48	3 M
							BURNET	USA NA	02.05.89						
363	F	268	277	02.05.89	. .	.063	BURNET	USA	02.05.89	LV363	0363	SSP	46	48	
							OGLEBAY	USA NA	12.12.90						
364	F	268	277	02.05.89	. .	.063	BURNET	USA	02.05.89	LV364	0364	SSP	46	48	
							BURNET	USA NA	02.05.89						
365	F	268	277	02.05.89	03.05.89	.063	BURNET	USA	02.05.89	LV365	0365	SSP	46	48	1 D
							BURNET	USA NA	02.05.89						
366	F	327	304	03.05.89	03.05.89	.063	ROSS PARK	USA	03.05.89	NW366	0366	SSP	22	36	0 D
							ROSS PARK	USA NA	03.05.89						
367	M	291	233	03.05.89	06.05.89	.039	FOSSIL RIM	USA	03.05.89	YE367	0367	SSP	34	72	3 D
							FOSSIL RIM	USA NA	03.05.89						
368	M	291	233	03.05.89	. .	.039	FOSSIL RIM	USA	03.05.89	YE368	0368	SSP	34	72	
							TACOMA	USA NA	11.12.90						
369	M	291	233	03.05.89	. .	.039	FOSSIL RIM	USA	03.05.89	YE369	0369	SSP	34	72	
							BIRMINGHAM	USA NA	11.12.90						
370	F	291	233	03.05.89	08.05.89	.039	FOSSIL RIM	USA	03.05.89	YE370	0370	SSP	34	72	5 D
							FOSSIL RIM	USA NA	03.05.89						
371	F	291	233	03.05.89	. .	.039	FOSSIL RIM	USA	03.05.89	YE371	0371	SSP	34	72	
							TACOMA	USA NA	13.12.89						
372	M	280	245	06.05.89	. .	.125	MISSISSIPPI	USA	06.05.89	USPS372	0372	SSP	46	72	
							MISSISSIPPI	USA NA	06.05.89						
373	M	280	245	06.05.89	. .	.125	MISSISSIPPI	USA	06.05.89	USPS373	0373	SSP	46	72	
							N. CAROLINA	USA NA	09.11.90						
374	M	280	245	06.05.89	. .	.125	MISSISSIPPI	USA	06.05.89	USPS374	0374	SSP	46	72	
							N. CAROLINA	USA NA	05.01.90						
375	M	280	245	06.05.89	. .	.125	MISSISSIPPI	USA	06.05.89	USPS375	0375	SSP	46	72	
							S. CAROLINA	USA NA	15.01.90						
376	F	280	245	06.05.89	. .	.125	MISSISSIPPI	USA	06.05.89	USPS376	0376	SSP	46	72	
							MISSISSIPPI	USA NA	06.05.89						
377	F	280	245	06.05.89	. .	.125	MISSISSIPPI	USA	06.05.89	USPS377	0377	SSP	46	72	
							MISSISSIPPI	USA NA	06.05.89						
378	F	280	245	06.05.89	. .	.125	MISSISSIPPI	USA	06.05.89	USPS378	0378	SSP	46	72	
							SMOKIES	USA NA	15.01.91						

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Stbk #	Sex	Sire #	Dam #	Date of Birth	Date of Death	Inbr. Coeff.	First location / Location now		- arrived / - since	Breeder # / Housename	Last ISIS	Mng Grp	Sire Age	Dam Age	Death Age
379	F	242	289	14.05.89	. .	.125	S. CAROLINA	USA	14.05.89	FWS379	0379	SSP	70	37	
							S. CAROLINA	USA NA	14.05.89						
380	F	242	289	14.05.89	. .	.125	S. CAROLINA	USA	14.05.89	FWS380	0380	SSP	70	37	
							N. CAROLINA	USA NA	17.04.90						
381	F	242	289	14.05.89	31.08.89	.125	S. CAROLINA	USA	14.05.89	FWS381	0381	SSP	70	37	4 M
							S. CAROLINA	USA NA	14.05.89						
382	F	242	289	14.05.89	. .	.125	S. CAROLINA	USA	14.05.89	FWS382	0382	SSP	70	37	
							N. CAROLINA	USA NA	17.04.90						
383	F	242	289	14.05.89	. .	.125	S. CAROLINA	USA	14.05.89	FWS383	0383	SSP	70	37	
							N. CAROLINA	USA NA	16.01.90						
384	M	212	195	21.05.89	23.05.89		TACOMA	USA	21.05.89	WG384	0384	SSP	83	97	2 D
							TACOMA	USA NA	21.05.89						
385	M	212	195	21.05.89	24.05.89		TACOMA	USA	21.05.89	WG385	0385	SSP	83	97	3 D
							TACOMA	USA NA	21.05.89						
386	M	212	195	21.05.89	. .		TACOMA	USA	21.05.89	WG386	0386	SSP	83	97	
							ROGER WILLIA	USA NA	07.01.91						
387	M	212	195	21.05.89	. .		TACOMA	USA	21.05.89	WG387	0387	SSP	83	97	
							BURNET	USA NA	04.12.90						
388	F	212	195	21.05.89	. .		TACOMA	USA	21.05.89	WG388	0388	SSP	83	97	
							ROSS PARK	USA NA	05.09.90						
389	F	212	195	21.05.89	05.12.89		TACOMA	USA	21.05.89	WG389	0389	SSP	83	97	6 M
							TACOMA	USA NA	21.05.89						
390	F	212	195	21.05.89	. .		TACOMA	USA	21.05.89	WG390	0390	SSP	83	97	
							BIRMINGHAM	USA NA	04.12.90						
391	F	212	195	21.05.89	. .		TACOMA	USA	21.05.89	WG391	0391	SSP	83	97	
							TACOMA	USA NA	21.05.89						
392	M	227	205	27.04.89	. .	.094	N. CAROLINA	USA	27.04.89	FWS392	0392	SSP	70	84	
							N. CAROLINA	USA NA	27.04.89						
393	F	227	205	27.04.89	24.01.90	.094	N. CAROLINA	USA	27.04.89	FWS393	0393	SSP	70	84	9 M
							N. CAROLINA	USA NA	27.04.89						
394	F	227	205	27.04.89	. .	.094	N. CAROLINA	USA	27.04.89	FWS394	0394	SSP	70	84	
							N. CAROLINA	USA NA	27.04.89						
395	F	227	205	27.04.89	11.01.90	.094	N. CAROLINA	USA	27.04.89	FWS395	0395	SSP	70	84	8 M
							N. CAROLINA	USA NA	27.04.89						
396	M	327	304	09.04.90	11.04.90	.063	ROSS PARK	USA	09.04.90	NW396	0396	SSP	33	47	2 D
							ROSS PARK	USA NA	09.04.90						

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397	M	327	304	09.04.90	12.10.90	.063	ROSS PARK	USA	09.04.90	MW397	0397	SSP	33	47	6 M
							DURANT IS.	USA NA	12.07.90						
398	F	327	304	09.04.90	15.10.90	.063	ROSS PARK	USA	09.04.90	MW398	0398	SSP	33	47	6 M
							DURANT IS.	USA NA	12.07.90						
399	F	327	304	09.04.90	12.10.90	.063	ROSS PARK	USA	09.04.90	MW399	0399	SSP	33	47	6 M
							DURANT IS.	USA NA	12.07.90						
400	F	327	304	09.04.90	07.08.90	.063	ROSS PARK	USA	09.04.90	MW400	0400	SSP	33	47	4 M
							DURANT IS.	USA NA	12.07.90						
401	U	327	304	09.04.90	03.05.90	.063	ROSS PARK	USA	09.04.90	MW401	0401	SSP	33	47	24 D
							ROSS PARK	USA NA	09.04.90						
402	U	327	304	09.04.90	03.05.90	.063	ROSS PARK	USA	09.04.90	MW402	0402	SSP	33	47	24 D
							ROSS PARK	USA NA	09.04.90						
403	M	293	248	10.04.90	11.04.90	.031	VIC. TX	USA	10.04.90	UH403	0403	SSP	45	72	1 D
							VIC. TX	USA NA	10.04.90						
404	M	293	248	10.04.90	12.04.90	.031	VIC. TX	USA	10.04.90	UH404	0404	SSP	45	72	2 D
							VIC. TX	USA NA	10.04.90						
405	M	293	248	10.04.90	. .	.031	VIC. TX	USA	10.04.90	UH405	0405	SSP	45	72	
							BEARDSLEY ZO	USA NA	13.12.90						
406	M	293	248	10.04.90	. .	.031	VIC. TX	USA	10.04.90	UH406	0406	SSP	45	72	
							ALEX	USA NA	19.12.90						
407	F	293	248	10.04.90	19.04.90	.031	VIC. TX	USA	10.04.90	UH407	0407	SSP	45	72	9 D
							VIC. TX	USA NA	10.04.90						
408	F	293	248	10.04.90	. .	.031	VIC. TX	USA	10.04.90	UH408	0408	SSP	45	72	
							FOSSIL RIM	USA NA	08.01.91						
409	F	293	248	10.04.90	. .	.031	VIC. TX	USA	10.04.90	UH409	0409	SSP	45	72	
							FOSSIL RIM	USA NA	08.01.91						
410	M	219	303	23.04.90	. .	.063	ST. VINCENT	USA	23.04.90	410	0410	SSP	82	48	
							ST. VINCENT	USA NA	23.04.90						
411	M	219	303	23.04.90	. .	.063	ST. VINCENT	USA	23.04.90	411	0411	SSP	82	48	
							N. CAROLINA	USA NA	06.12.90						
412	M	335	277	29.04.90	30.04.90	.031	TACOMA	USA	29.04.90	WG412	0412	SSP	22	60	1 D
							TACOMA	USA NA	29.04.90						
413	M	335	277	29.04.90	30.04.90	.031	TACOMA	USA	29.04.90	WG413	0413	SSP	22	60	1 D
							TACOMA	USA NA	29.04.90						
414	M	335	277	29.04.90	30.04.90	.031	TACOMA	USA	29.04.90	WG414	0414	SSP	22	60	1 D
							TACOMA	USA NA	29.04.90						

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415	M	335	277	29.04.90	30.04.90	.031	TACOMA	USA	29.04.90	WG415	0415	SSP	22	60	1 D
							TACOMA	USA NA	29.04.90						
416	M	335	277	29.04.90	30.04.90	.031	TACOMA	USA	29.04.90	WG416	0416	SSP	22	60	1 D
							TACOMA	USA NA	29.04.90						
417	F	335	277	29.04.90	30.04.90	.031	TACOMA	USA	29.04.90	WG417	0417	SSP	22	60	1 D
							TACOMA	USA NA	29.04.90						
418	F	335	277	29.04.90	30.04.90	.031	TACOMA	USA	29.04.90	WG418	0418	SSP	22	60	1 D
							TACOMA	USA NA	29.04.90						
419	F	335	277	29.04.90	. .	.031	TACOMA	USA	29.04.90	WG419	0419	SSP	22	60	
							TACOMA	USA NA	29.04.90						
420	F	335	277	29.04.90	. .	.031	TACOMA	USA	29.04.90	WG420	0420	SSP	22	60	
							TACOMA	USA NA	29.04.90						
421	M	282	278	01.05.90	. .	.031	OGLEBAY	USA	01.05.90	WJ421	0421	SSP	58	60	
							TACOMA	USA NA	13.12.90						
422	F	282	278	01.05.90	01.05.90	.031	OGLEBAY	USA	01.05.90	WJ422	0422	SSP	58	60	0 D
							OGLEBAY	USA NA	01.05.90						
423	F	282	278	01.05.90	03.05.90	.031	OGLEBAY	USA	01.05.90	WJ423	0423	SSP	58	60	2 D
							OGLEBAY	USA NA	01.05.90						
424	F	282	278	01.05.90	15.01.91	.031	OGLEBAY	USA	01.05.90	WJ424	0424	SSP	58	60	8 M
							OGLEBAY	USA NA	01.05.90						
425	F	282	278	01.05.90	. .	.031	OGLEBAY	USA	01.05.90	WJ425	0425	SSP	58	60	
							OGLEBAY	USA NA	01.05.90						
426	M	328	313	02.05.90	. .	.094	N. CAROLINA	USA	02.05.90	FWS426	0426	SSP	34	36	
							N. CAROLINA	USA NA	02.05.90						
427	M	328	313	02.05.90	20.10.90	.094	N. CAROLINA	USA	02.05.90	FWS427	0427	SSP	34	36	6 M
							N. CAROLINA	USA NA	02.05.90						
428	M	328	313	02.05.90	. .	.094	N. CAROLINA	USA	02.05.90	FWS428	0428	SSP	34	36	
							TACOMA	USA NA	23.08.90						
429	M	328	313	02.05.90	28.01.91	.094	N. CAROLINA	USA	02.05.90	FWS429	0429	SSP	34	36	9 M
							TACOMA	USA NA	20.11.90						
430	F	328	313	02.05.90	. .	.094	N. CAROLINA	USA	02.05.90	FWS430	0430	SSP	34	36	
							N. CAROLINA	USA NA	02.05.90						
431	M	212	297	04.05.90	. .	.125	TACOMA	USA	04.05.90	WG431	0431	SSP	94	48	
							TACOMA	USA NA	04.05.90						
432	M	212	297	04.05.90	. .	.125	TACOMA	USA	04.05.90	WG432	0432	SSP	94	48	
							TACOMA	USA NA	04.05.90						

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433	F	212	297	04.05.90	05.05.90	.125	TACOMA	USA	04.05.90	WG433	0433	SSP	94	48	1 D
							TACOMA	USA NA	04.05.90						
434	F	212	297	04.05.90	28.01.91	.125	TACOMA	USA	04.05.90	WG434	0434	SSP	94	48	9 M
							TACOMA	USA NA	04.05.90						
435	M	294	301	10.05.90	18.05.90	.070	TACOMA	USA	10.05.90	WG435	0435	SSP	46	48	8 D
							TACOMA	USA NA	10.05.90						
436	M	294	301	10.05.90	. .	.070	TACOMA	USA	10.05.90	WG436	0436	SSP	46	48	
							TACOMA	USA NA	10.05.90						
437	F	294	301	10.05.90	. .	.070	TACOMA	USA	10.05.90	WG437	0437	SSP	46	48	
							TACOMA	USA NA	10.05.90						
438	F	294	301	10.05.90	. .	.070	TACOMA	USA	10.05.90	WG438	0438	SSP	46	48	
							TACOMA	USA NA	10.05.90						
439	F	294	301	10.05.90	. .	.070	TACOMA	USA	10.05.90	WG439	0439	SSP	46	48	
							TACOMA	USA NA	10.05.90						
440	F	341	243	17.05.90	. .	.047	BEARDSLEY ZO	USA	17.05.90	DP440	0440	SSP	22	84	
							FOSSIL RIM	USA NA	22.01.91						
441	F	341	243	17.05.90	. .	.047	BEARDSLEY ZO	USA	17.05.90	DP441	0441	SSP	22	84	
							FOSSIL RIM	USA NA	22.01.91						
442	M	319	300	07.05.90	. .	.055	N. CAROLINA	USA	07.05.90	FWS442	0442	SSP	34	48	
							N. CAROLINA	USA NA	07.05.90						
443	F	319	300	07.05.90	. .	.055	N. CAROLINA	USA	07.05.90	FWS443	0443	SSP	34	48	
							N. CAROLINA	USA NA	07.05.90						
444	F	319	300	07.05.90	. .	.055	N. CAROLINA	USA	07.05.90	FWS444	0444	SSP	34	48	
							N. CAROLINA	USA	07.05.90						

Males - 183 Females - 214 Unknown - 47

PART IV

RECOVERY STRATEGY

A. Goal

Achieve a series of disjunct populations of red wolves, through reintroduction, that are numerically large enough to have the potential for allowing natural evolutionary processes to work within the species.

Objective No. 1: To preserve 80 to 90 percent genetic diversity of the species for 150 years.

Objective No. 2: To remove those threats that have the potential to bring about extinction of the species. Achieving this objective will require a wild population of approximately 220 animals and a captive population of approximately 330 animals.

Objective No. 3: To maintain the red wolf in perpetuity through cryogenic preservation of sperm and embryo banking.

B. Narrative

1. Coordinate and manage the red wolf recovery program. A full-time program coordinator is essential to maintain recovery direction and assure continuity of various objectives. The coordinator also provides leadership, establishes annual objectives and goals, develops budgetary needs, and serves as the spokesperson for the program.

2. Maintain a Red Wolf Recovery Team. A systematic biological review process is essential in a highly complex recovery effort. Periodic recovery team meetings are necessary to review progress and address special biological needs. The current team is composed of individuals with special skills and expertise applicable to the various objectives of this recovery plan.

3. Reestablish three or more wild populations totaling approximately 220 red wolves within the species' historic range. To preserve the genetic integrity of the species, it has been determined that at least three disjunct populations of red wolves will be needed. These discrete populations will have to maintain approximately 220 animals.

   3.1 Identify reintroduction sites. Potential sites must be carefully assessed. At the present time it appears that such sites must be in Federal ownership and contain at least 170,000 acres of contiguous habitat within the historic range of the red wolf.

      3.1.1 Through cursory field and literature examinations, develop a list of potential reintroduction sites and prioritize the list. This "wish list" should include all properties that meet the above criterion. Initially, national wildlife refuge system lands are to be preferred, followed by national park system properties. It is thought that Department of the Interior properties would offer greater opportunities for successfully carrying out a reintroduction project. This is predicated on basic land management objectives and mandates of the two agencies. A series of highly visible, successfully executed red wolf reintroductions on Department of the Interior lands would provide invaluable experience to project personnel and would build substantial program credibility. After several successful projects, other Federal lands might become available to the program. In addition, the potential of lease agreements on private lands will likely become a viable strategy in the future. In this

context, utilizing private lands to connect otherwise disjunct and isolated populations could offer significant opportunities for achieving program goals. Combining Federal, State, and private properties into a wolf management zone could be made feasible by providing inducements such as tax incentives to participating property owners.

3.1.2 In priority order, examine potential reintroduction sites for essential biological parameters (prey abundance, habitat types, disease and parasites, etc), and socioeconomic factors (agricultural practices, land ownership patterns, proximity of towns and communities, etc.). In most instances basic biological studies of an area will have already been accomplished and data will be available, especially on Department of the Interior lands. Where not available, however, a biological base will have to be established. This may require conducting cursory field collecting exercises, habitat assessments, etc. Socioeconomic factors should be closely examined and potential problems with a major predator reintroduction realistically addressed early on. Only then can a strategy be developed to offset these problems.

3.1.3 Measure potential public response to a wolf reintroduction through selected contacts with knowledgeable field personnel at State, Federal, and national environmental organization level. Of great importance is the identification of certain key individuals in a potential project area. Time must be spent in explaining the rationale for such a project and in cultivating their support for a wolf reintroduction. The help of these individuals and organizations will later prove to be of immense value if the site is selected.

3.1.4 Estimate resident canid composition and density. Develop basic data base on resident canids. Surveys of trapping results, discussions with professional biologists and local hunters and trappers, and track examinations on selected dirt roads and trails will give a general idea of feral dog and coyote incidence. More definitive studies would involve systematic siren surveys and analyses of field-recorded vocalizations.

3.1.5 Develop and implement an experimental red wolf/coyote interaction study. A red wolf/coyote investigation has recently been initiated in the Great Smoky Mountains National Park. This study will examine home-range movement patterns of resident coyote populations. After 12 to 18 months of study, a carefully selected red wolf pair and their pups will be released into the study area after appropriate acclimation. Movements and interactions of wolves and coyotes will be monitored for a period of time. Released red wolves and subsequent offspring will be designated as experimental and nonessential and a special regulation so prepared. If possible, a second coyote/red wolf interaction investigation in a coastal plain habitat should be initiated. Results of these investigations should provide significant information for long-range planning purposes.

3.1.6 Develop a priority list of potentially feasible reintroduction sites. After a careful examination of available sites that meet definable criteria, certain sites will surface to the top of the list. The final selection will likely be based on certain key determinants such as geography, isolation, political considerations, etc.

3.1.7 Beginning with the most feasible site, coordinate a potential reintroduction project with appropriate Federal, State, and county officials and selected residents and landowners. Utilizing experience gained from the execution of Task 3.1.3, assess where to initiate this most important task. In some cases this will be at the local level, and in others it will be at the State or Federal political level. Up to 1 year of careful coordination may be required before a proposal is ready to enter into the public meeting phase.

3.1.8 Develop a detailed reintroduction technical proposal and necessary NEPA documents. A well-defined and readily understood technical document is of the utmost importance. This document must detail all aspects of a wolf reintroduction, including historic perspectives, facts about the red wolf, reintroduction goals, etc. A key section of great importance to local residents would relate to the effects of a wolf

reintroduction. An environmental assessment should be drafted that assesses the proposal's impact on the local environment and economy.

3.1.9 <u>Conduct public meetings; develop responsible media relationship.</u> Great effort must be exercised in permitting the local public to express their concerns about the project. These forums provide the Service with the opportunity to present factual information about the red wolf and about the various components of the proposal. Much care must be directed at inviting appropriate State and county officials to these meetings. Enough meetings should be scheduled to fully allow public input. In dealing with the media, be factual and avoid speculation about the proposal.

3.1.10 <u>Develop an experimental regulation tailored to the specific needs of the reintroduction site.</u> Much attention should be given to the development of an experimental regulation as set forth under Section 10(j) of the Endangered Species Act. In addition to forming a legal basis for reintroduction of an otherwise endangered species, this regulation can also address local concerns and ideas brought forward at the public meetings. In essence, the regulation can be tailored to local situations and expressed needs so long as these needs do not undermine the objectives of the project. The draft regulation should also be developed in concert with local and national conservation organizations.

3.1.11 <u>Construct necessary acclimation pens and purchase required equipment.</u> As soon as funding is secured, public response is measured, and the proposal is acceptable to key State and Federal officials, work can proceed with the required pen construction and the purchase of the great variety of equipment required by a major mainland reintroduction project. The technical proposal developed under Task 3.1.8 will provide equipment needs.

3.2 <u>Introduce red wolves.</u> Animals should be shipped to the project site, placed in acclimation pens for approximately 6 months, and released.

3.2.1 <u>Acclimate red wolves.</u> During acclimation, animals should be fed native prey species and

kept from human disturbance as much as possible; their homing instincts will be reoriented to the project site. To maximize productivity, it is wise to allow the adults to breed and have pups while in captive acclimation. Prior to release, adults and young should receive health checks and shots. New tracking collars should be fitted to adults and transmitters surgically implanted in pups.

3.2.2 Release red wolves. Timing of a wolf release should be carefully considered. The spring and summer part of the year is possibly best since an abundance of young, inexperienced prey species are generally available. Local conditions and project objectives will dictate the optimum time for release.

3.2.3 Monitor released wolves. Only the latest and most proven telemetry equipment should be utilized in a reintroduction project. Heavy emphasis must be given to tracking released animals during early stages of the project. Human/wolf interactions must be avoided, and only through a carefully conceived tracking program can this be minimized. As wolves settle into a routine, tracking schedules can be scaled back. Aircraft tracking has proven to be the most efficient method of monitoring red wolves.

3.2.4 Monitor prey species. Pre- and post-release prey surveys can be conducted if circumstances warrant. Such surveys, however, must be carefully designed if direct predator/prey relationships are to be demonstrated. The sensitivity of such surveys is critical and may prove to be beyond the capability of the project. Standard field techniques may suffice. Such techniques include wolf scat analyses and observational information, hunter kill records of key prey species, etc.

3.2.5 Assess success of reintroduction. Success can be measured in a variety of ways. The planner should spend time in defining this important point. It can be demonstrated in terms of biological parameters, but of possible equal importance is the concept of success as determined by public response and cooperation with a wolf reintroduction. Biological success may be easier to define, but in the long-term analysis, the human factor is of vital

importance. Project personnel should strive to keep local residents aware of project status and solicit input from the public on important issues. Documentation of a successful (or unsuccessful) wolf reintroduction is of vital importance in planning future efforts.

4. Develop at least three red wolf propagation projects on suitable islands along the South Atlantic and Gulf Coasts and in suitable mainland enclosures. An integral component of the strategy to prevent genetic drift and infuse wildness into the red wolf program is to establish small island and mainland enclosure projects. These projects are envisioned strictly as propagation efforts and are adjuncts to mainland reintroductions. They will provide wild pups for either infusion into the captive-breeding program or for direct release into mainland projects. These projects also can serve to build public relations in select areas. Small fenced enclosures as small as 1 to 5 acres (.4 to 2 ha) can also serve as intermediate holding facilities for animals scheduled for release or for emergency holding purposes.

4.1 Identify potential propagation sites. Few islands along the South Atlantic and Gulf Coast offer the rigid requirements for a project of this nature. Ownership, acreage, prey base, and logistical support capability are all key criteria. It is thought that an island of at least 3,500 acres is needed to sustain an adult pair of red wolves and their offspring for a short period of time. Mainland enclosures will vary significantly, depending on circumstances relating to the size of the compound or enclosure.

4.1.1 Through cursory field and literature examinations, develop a list of potential propagation sites. Initially, attention should be limited to those islands within the species' historic range that are within the national wildlife refuge or national park systems. These islands must exhibit those general characteristics mentioned above in 4.1. Mainland propagation sites, on the other hand, may include existing enclosures such as surplus compounds on military facilities or abandoned U.S. Forest Service study enclosures. These will vary from site to site, but to fulfill project needs, such enclosures should be no less than 640 acres.

4.1.2 In priority order, examine potential propagation sites for essential biological parameters (prey abundance, habitat types, disease and parasites,

etc.) and socioeconomic factors (agricultural practices, land use, proximity of towns and communities, etc.). In most instances, basic biological studies of an island situation will already be accomplished and data will be available, especially on Department of the Interior properties. Where an updating is required or basic information is not available, cursory field collecting exercises, habitat assessments, etc., will be required. Socioeconomic factors must be carefully considered. Public use of an island is a major consideration. It has been found that moderate public use, including hunting, should not automatically preclude an island from consideration. Mainland enclosures should only be considered if they are remote and/or well-secured sites. Prey availability is a major factor in such situations. If current biological data is not available, cursory surveys of these sites will be required.

4.1.3 Measure potential public response to a wolf propagation project through selected contacts, including knowledgeable personnel at the State and Federal level. Of great importance is the identification of certain key individuals who reside near a potential propagation site. Discussions with these individuals will usually yield invaluable clues regarding likely public reaction to a project. The help of these people will later prove to be of immense value if the site is selected for a project.

4.1.4 Estimate the resident canid population if an island project is under consideration. The presence of feral dogs and coyotes on an island will usually be readily evident from discussions with professional biologists, rangers, etc. If questions persist, examine tracks on dirt roads and beach areas. More definitive investigations would involve siren surveys.

4.1.5 Examine the compatibility of the propagation site ecosystem to the population of red wolves. The capability of a site to support red wolves and determining what impacts these predatory animals would have on resident fauna, especially species that are protected by State or Federal law, need evaluation. Include species of concern as well as species being considered for protection.

4.1.6 Develop a priority list of potentially feasible propagation sites. After a careful examination of available sites utilizing the definable criteria described above, certain sites will surface to the top of the list. The final selection will probably be resolved on the basis of ownership, security, geography, and political considerations.

4.1.7 Beginning with the most feasible propagation site, initiate formal coordination efforts with appropriate Federal, State, and county officials, as well as key residents, property owners, etc. Utilizing experience gained from the execution of Task 4.1.3, where to initiate this most important task should be assessed. In some cases this will be at the local level, and in others it will be at the State or Federal political level. Up to 1 year of careful planning may be necessary before the project is ready to enter into the public meeting stage.

4.1.8 Develop a detailed propagation proposal as well as necessary NEPA documents and a Section 7 evaluation. A well-defined, factual, and readily understood technical proposal is of the utmost importance. This document should detail all aspects of a red wolf propagation project, including historical information, facts about the red wolf, other projects and their status, project objectives, etc. A key section of great importance to any interested resident would relate to the project's ability to recapture any animal that should happen to escape. An environmental assessment and Section 7 evaluation would have to be completed by appropriate Service personnel.

4.1.9 Conduct public meetings if deemed necessary; develop a responsible media relationship. Service experience with red wolf projects indicates the public meeting process is of vital importance. If a propagation project is being attempted on another agency's property, however, that agency will have to make the determination to host a public meeting or not. If a public meeting is determined to be necessary, great effort must be exercised in developing a presentation that is fully factual. Provide time for the public to express their concerns and perceived fears. Generally, a project of this nature will be poorly understood by the

public, even after extensive efforts are made to explain the project in the media, etc. In dealing with the media, present only factual information, not speculation.

4.1.10 <u>Construct necessary acclimation pens and secure equipment needed for the project.</u> As soon as public response is measured and funding is secured, the proposal should be formally accepted by key State and Federal officials. Work can proceed on construction of the acclimation pen (or the upgrade of an existing mainland enclosure), and the purchase of vital equipment can be initiated. The technical proposal developed under Task 4.1.8 will provide equipment needs.

4.2 <u>Propagate red wolves.</u> Captive-reared red wolves should be utilized in efforts to propagate wild offspring.

4.2.1 <u>Acclimate red wolves.</u> During the acclimation process on island situations, animals should be fed native prey species and be kept away from human contact as much as possible; their homing instincts will become reoriented to the project site. Temporary tracking collars should be fitted to each adult so the animals will be used to wearing these devices when released. Timing of the acclimation process should coincide with the breeding period and whelping of pups. Pups should be captured several weeks prior to release, and small transmitters should be surgically implanted into their abdominal cavities.

4.2.2 <u>Release red wolf family unit into island situation.</u> Due to techniques employed in the acclimation process, animals should normally be released by mid-July. This also coincides with prey species' being at high levels. Supplemental feeding may be required in some situations and will vary from project to project.

4.2.3 <u>Monitor released family units on island sites.</u> Intensity of monitoring will vary from island to island, depending on geographic features and specific objectives of each project. In situations where animals could reach the mainland by swimming narrow water barriers, tracking frequency should have to be at maximum levels, especially during early phases of the

project. On most island sites, tracking can be accomplished on foot, by vehicle, or from a boat.

4.2.4 Monitor prey species on island sites. Both pre- and post-project prey surveys can be conducted if circumstances warrant. Such surveys, however, must be carefully designed if direct predator/prey relationships are to be demonstrated. The sensitivity of such surveys is critical and may prove to be beyond the capability of the project. Standard field techniques may suffice. Such techniques include wolf scat analysis and observational information, hunter kill records of key prey species, etc.

4.2.5 If a mainland captive project is initiated, monitor adults and capture offspring at 8 to 10 months of age. Mainland propagation projects probably don't lend themselves as well to the rearing of wild pups as islands do. This relates to the relatively small size of typical enclosures. Some military compounds, however, could be of sufficient size to allow natural processes to function. These processes are, of course, related to typical predator/prey relationships. The degree of wildness that could be expected from pups so acclimated is yet to be determined. When such opportunities arise, the program should address this potential technique. Animals in enclosures could be monitored utilizing the same techniques mentioned in Task 4.2.4.

4.2.6 Capture island-born offspring at 7 to 8 months of age. Since this propagation strategy involves the use of offspring with implant tracking transmitters, retrieval of these young animals at 7 to 8 months of age is greatly simplified. At this time, adults should also be caught and placed back in pens for a new cycle of breeding and pup rearing. Experiences to date indicate that the island animals can be recaptured by baiting them back into the acclimation pen.

5. Additional land acquisition on Service properties.

5.1 Secure, by fee acquisition or long-term lease agreements, properties adjacent to or within the proximity of Alligator River National Wildlife Refuge.

North Carolina. Such additions would significantly enhance the effectiveness of this major project for the benefit of the red wolf. When and if other national wildlife refuge system lands serve as future red wolf reintroduction sites, such land acquisitions and leases should be encouraged.

6. Develop captive-breeding facilities capable of providing animals for reintroduction purposes as well as safeguarding the genetic integrity of the species.

   6.1 Expand and maintain captive-breeding capability to accommodate 330 red wolves. The Service contract with the Point Defiance Zoo was expanded significantly in fiscal year 1989. This increase in funding will permit a twofold increase in the Point Defiance Zoo project facility and also substantially expand the number of participating public and private zoos in the United States to hold red wolves.

   6.2 Maintain the integrity of brood stock through continued implementation of a breeding program with the AAZPA. The Service should cooperate with AAZPA to ensure that the red wolf studbook is accurately maintained. Service recovery planning should be integrated with AAZPA SSP formulation. This will ensure that suitable numbers of red wolves are available for reintroduction and propagation projects. This cooperative effort should also facilitate selection of red wolf recipients and ensure that participating zoos and facilities adhere strictly to established regulations and protocols.

   6.3 Initiate red wolf genetic investigations. Contract with a recognized authority to utilize state-of-the-art biochemical techniques to address the issue of red wolf speciation.

7. Develop a strategy for the cryogenic preservation of red wolf sperm and embryo banking.

   7.1 Develop protocols for F_1 generation sperm and embryo banking utilizing cryogenic techniques. Significant advances in long-term storage of embryos and sperm in bovids have been accomplished in recent years. Little work has been attempted with canids. To ensure the preservation of critical red wolf genetic material, specific protocols for the collection and long-term storage of sperm and embryos should be developed.

   7.2 Contract with an appropriate facility to maintain genetic material. The Service should contract this aspect of the recovery effort.

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PART ~~III~~ V

IMPLEMENTATION SCHEDULE

Priorities in column one of the following implementation schedule are assigned as follows:

1. Priority 1 - An action that <u>must</u> be taken to prevent extinction or to prevent the species from declining irreversibly in the <u>foreseeable</u> future.

2. Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

3. Priority 3 - All other actions necessary to meet the recovery objective.

<u>Key to Acronyms Used in This Implementation Schedule</u>

AAZPA - American Association of Zoological Parks and Aquariums
FS - U.S. Forest Service
FWS - U.S. Fish and Wildlife Service
FWE - Fish and Wildlife Enhancement (Division of FWS)
NPS - National Park Service
PDZ - Point Defiance Zoo, Tacoma, Washington
TNC - The Nature Conservancy

IMPLEMENTATION SCHEDULE

PRIOR-ITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY FWS Region	RESPONSIBLE PARTY FWS Program	RESPONSIBLE PARTY Other	COST ESTIMATES ($000'S) FY 1990	COST ESTIMATES ($000'S) FY 1991	COST ESTIMATES ($000'S) FY 1992	COMMENTS
1	1.0	Coordinate and manage the red wolf recovery program.	Ongoing	4	FWE		67	62	62	
3	2.0	Maintain a Red Wolf Recovery Team.	Ongoing	4	FWE		6	4.5	4.5	
2	3.1.1	List potential reintroduction sites.	Ongoing	4	FWE		2	.5	.5	
2	3.1.2	In priority order, examine potential reintroduction sites.	4 years	4	FWE	NPS, FS	2	1	1	
2	3.1.3	Measure potential public response to a wolf reintroduction.	4 years	4	FWE	NPS, FS	2	2	2	
2	3.1.4	Estimate resident canid composition and density.	4 years	4	FWE	NPS, FS	2	1	1	

IMPLEMENTATION SCHEDULE

PRIOR-ITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY FWS Region	FWS Program	Other	COST ESTIMATES ($000'S) FY 1990	FY 1991	FY 1992	COMMENTS
2	3.1.5	Develop experimental red wolf/coyote interaction study.	3 years	4	FWE	NPS, FS	30	40	20	Contract investigation.
2	3.1.6	Develop priority list of reintroduction sites.	4 years	4	FWE		-0-	-0-	-0-	
2	3.1.7	Coordinate potential wolf reintroduction project.	Ongoing	4	FWE		3	2	1	
2	3.1.8	Develop a detailed reintroduction proposal.	Ongoing	4	FWE	NPS, FS	2	2	2	
2	3.1.9	Conduct public meetings.	Ongoing	4	FWE	NPS, FS	-0-	2	2	
2	3.1.10	Develop experimental regulation.	Ongoing	4	FWE	NPS, FS	1	.5	.5	
2	3.1.11	Construct acclimation pens; purchase equipment.	Ongoing	4	FWE	NPS, FS	20	20	65	
2	3.2.1	Acclimate red wolves.	Ongoing	4	FWE	NPS, FS	30	40	50	

IMPLEMENTATION SCHEDULE

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY			COST ESTIMATES ($000'S)			COMMENTS
				FWS		Other	FY 1990	FY 1991	FY 1992	
				Region	Program					
2	3.2.2	Release red wolves.	Ongoing	4	FWE		-0-	-0-	-0-	
2	3.2.3	Monitor released wolves.	Ongoing	4	FWE	NPS, FS	167	230	330	
3	3.2.4	Monitor prey species.	Ongoing	4	FWE	NPS, FS	-0-	20	20	
2	3.2.5	Assess reintroduction.	Ongoing	4	FWE	NPS, FS	2	-0-	-0-	
3	4.1.1	Develop a list of potential propagation sites.	1 year	4	FWE		-0-	-0-	-0-	
3	4.1.2	In priority order, examine potential propagation sites.	5 years	4	FWE		2	.5	.5	
3	4.1.3	Measure potential public response to a propagation project.	5 years	4	FWE	NPS, FS	2	.5	.5	
3	4.1.4	Estimate resident canid population.	5 years	4	FWE	NPS, FS	1	.5	.5	

IMPLEMENTATION SCHEDULE

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY FWS Region	FWS Program	Other	COST ESTIMATES ($000'S) FY 1990	FY 1991	FY 1992	COMMENTS
3	4.1.5	Examine compatibility of propagation site ecosystem to a small red wolf population.	5 years	4	FWE	NPS, FS	4.6	.5	.5	
3	4.1.6	Develop priority list of propagation sites.	2 years	4	FWE		1	-0-	-0-	
3	4.1.7	Coordinate potential propagation projects.	Ongoing	4	FWE		1	1	1	
3	4.1.8	Develop a detailed propagation proposal.	Ongoing	4	FWE		2	.5	.5	
3	4.1.9	Conduct public meetings if necessary.	Ongoing	4	FWE	NPS, FS	-0-	1	1	
3	4.1.10	Construct acclimation pens; purchase equipment.	Ongoing	4	FWE	NPS	5	5	5	
3	4.2.1	Acclimate red wolves.	Ongoing	4	FWE	NPS	10	15	15	

IMPLEMENTATION SCHEDULE

PRIOR-ITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY: FWS Region	RESPONSIBLE PARTY: FWS Program	RESPONSIBLE PARTY: Other	COST ESTIMATES ($000'S): FY 1990	COST ESTIMATES ($000'S): FY 1991	COST ESTIMATES ($000'S): FY 1992	COMMENTS
3	4.2.2	Release red wolves.	Ongoing	4	FWE	NPS	-0-	-0-	-0-	
3	4.2.3	Monitor released wolves.	Ongoing	4	FWE	NPS	5	23	25	
3	4.2.4	Monitor prey species on island sites.	Ongoing	4	FWE	See *1	15	-0-	-0-	Non-Federal funding.
3	4.2.5	If mainland project, monitor adults and capture pups at 8 to 9 months of age.	Ongoing	4	FWE	FS, and see *2	-0-	-0-	-0-	Mainland propagation projects scheduled for later years.
3	4.2.6	Capture island-born pups at 8 to 9 months of age.	Ongoing	4	FWE	NPS	2	2	3	
3	5.1	Additional land acquisitions.	Ongoing	4	FWE	TNC	-0-	-0-	-0-	
1	6.1	Expand captive-breeding capability.	5 years	4	FWE	PDZ	160	218	280	FWS contract.
2	6.2	Implement breeding program with AAZPA.	5 years	4	FWE	PDZ	2	-0-	-0-	

IMPLEMENTATION SCHEDULE

PRIOR-ITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY			COST ESTIMATES ($000'S)			COMMENTS
				FWS						
				Region	Program	Other	FY 1990	FY 1991	FY 1992	
3	6.3	Fund red wolf genetic investigation.	2 years	4	FWE	PDZ	25	10	-0-	
3	7.1	Develop protocols for sperm and embryo banking.	4 years	4	FWE	PDZ	10	5	5	FWS contract.
3	7.2	Contract cryogenic facility for preservation of genetic materials.	Ongoing	4	FWE	PDZ	3	5	15	FWS contract.

*1 - Other agencies' responsibilities would be of a cooperative nature or projects would be funded under a contract or grant program. In some cases contracts could be let to universities or private enterprises.

*2 - Military facilities.

Implementation Schedule Cost Information

1. Cost information set forth in this schedule is for planning purposes only. This aspect of the recovery plan will be refined through agency budget processes as new studies and/or management information dictates.

2. Initiation of some tasks is dependent on the completion and/or results of others. Therefore, target dates for some activities may require adjustments over time. Negotiations and planning for major reintroduction projects with Federal land management agencies may involve considerable time and effort. Reintroduction schedules presented in this plan are therefore subject to substantial variability.

RED WOLF RECOVERY PLAN FUNDING SUMMARY

FY 1 (Current Funding)	Funds Needed (In Thousands)	
	FY 2	FY 3
$445.0	$673.5	$948.5

PART VI

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214 F.3d 483
United States Court of Appeals,
Fourth Circuit.

Charles Gilbert GIBBS; Richard Lee Mann, III; Hyde County, North Carolina; Washington County, North Carolina, Plaintiffs-Appellants,
v.
Bruce BABBITT, Secretary of the Interior, in his official capacity; United States Fish and Wildlife Service; United States Department of the Interior; Jamie Clark, Director of the U.S. Fish and Wildlife Service, Defendants-Appellees,
Defenders of Wildlife, Intervenor-Appellee.
Pacific Legal Foundation; National Wilderness Institute; Washington Legal Foundation; The Allied Education Foundation; National Wildlife Federation; North Carolina Wildlife Federation; Environmental Defense Fund; World Wildlife Fund; Center for Marine Conservation, Amici Curiae.

No. 99-1218.
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Argued Oct. 28, 1999
|
Decided June 6, 2000

Synopsis

Individuals and counties brought action against Department of Interior and Fish and Wildlife Service (FWS), challenging the validity of a regulation limiting the taking of red wolves on private land. The United States District Court for the Eastern District of North Carolina, Terrence W. Boyle, Chief District Judge, 31 F.Supp.2d 531, granted summary judgment to defendants and denied plaintiffs' motion, and plaintiffs appealed. The Court of Appeals, Wilkinson, Chief Judge, held that the regulation was valid under the Commerce clause as involving regulable economic and commercial activity, and as an integral part of the overall federal scheme to protect, preserve, and rehabilitate endangered species.

Affirmed.

Luttig, Circuit Judge, filed a dissenting opinion.

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***486 ARGUED:** Sean Eric Andrussier, Womble, Carlyle, Sandridge & Rice, P.L.L.C., Raleigh, North Carolina, for Appellants. Andrew Christopher Mergen, United States Department of Justice, Washington, D.C.; Timothy Joseph Preso, Miller, Cassidy, Larroca & Lewin, L.L.P., Washington, D.C., for Appellees. **ON BRIEF:** E. Lawrence Davis, III, Christopher T. Graebe, Womble, Carlyle, Sandridge & Rice, P.L.L.C., Raleigh, North Carolina, for Appellants. Peter Coppelman, Acting Assistant Attorney General, David C. Shilton, Charles Carson, Environmental & Natural Resources Division, United States Department of Justice, Washington, D.C.; John Ebersole, David Gayer, United States Department of the Interior, Washington, D.C., for Federal Appellees. Scott L. Nelson, Miller, Cassidy, Larroca & Lewin, L.L.P., Washington, D.C.; Katherine Meyer, Meyer & Glitzenstein, Washington, D.C.; Derb S. Carter, Jr., Southern Environmental Law Center, Chapel Hill, North Carolina, for Appellee Defenders of Wildlife. M. Reed Hopper, Anne M. Hayes, Pacific Legal Foundation, Sacramento, California, for Amici Curiae Pacific Legal Foundation, et al. Daniel J. Popeo, Paul D. Kamenar, Washington Legal Foundation, Washington, D.C., for Amici Curiae Washington Legal Foundation, et al. James B. Dougherty, Washington, D.C., for Amici Curiae National Wildlife Federation, et al. Louis R. Cohen, James R. Wrathall, Matthew A. Brill, Susan A. MacIntyre, Wilmer, Cutler & Pickering, Washington, D.C.; Michael J. Bean, Environmental Defense Fund, Washington, D.C.; Christopher E. Williams, World Wildlife Fund, Washington, D.C.; Wm. Robert Irvin, Center for Marine Conservation, Washington, D.C., for Amici Curiae Environmental Defense Fund, et al.

Before WILKINSON, Chief Judge, and LUTTIG and MICHAEL, Circuit Judges.

Opinion

Affirmed by published opinion. Chief Judge WILKINSON wrote the majority opinion, in which Judge MICHAEL joined. Judge LUTTIG wrote a dissenting opinion.

OPINION

WILKINSON, Chief Judge:

In this case we ask whether the national government can

act to conserve scarce natural resources of value to our entire country. Appellants challenge the constitutionality of a Fish and Wildlife Service regulation that limits the taking of red wolves on private land. The district court ***487** upheld the regulation as a valid exercise of federal power under the Commerce Clause. We now affirm because the regulated activity substantially affects interstate commerce and because the regulation is part of a comprehensive federal program for the protection of endangered species. Judicial deference to the judgment of the democratic branches is therefore appropriate.

I.

A.

In response to growing concern over the extinction of many animal and plant species, Congress enacted the Endangered Species Act of 1973(ESA), Pub.L. 93-205, 81 Stat. 884 (codified as amended at 16 U.S.C. §§ 1531-44 (1994 & Supp. III 1997)). Congress found that many of the species threatened with extinction are of "esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people." 16 U.S.C. § 1531(a)(3) (1994). Congress also found that "various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation." *Id.* § 1531(a)(1). To address these national concerns, the ESA sets forth a comprehensive regulatory scheme to conserve these species and the ecosystems upon which they depend. The Act provides, *inter alia*, for the listing of "endangered" and "threatened" species, *id.* § 1533, and various recovery plans for the "conservation and survival" of listed species, *id.* § 1533(f).

The cornerstone of the statute is section 9(a)(1), which prohibits the taking of any endangered species without a permit or other authorization. *Id.* § 1538(a)(1)(B). The term "take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." *Id.* § 1532(19). The ESA also authorizes the Fish and Wildlife Service (FWS) to issue any necessary regulations for the conservation of threatened species. *Id.* § 1533(d). Finally, in keeping with its commitment to species conservation, the ESA states that a state law may be more restrictive than the provisions of the Act, but not less. *Id.* § 1535(f).

In order to increase the Service's flexibility in reintroducing endangered species into portions of their historic range, Congress extensively amended the ESA in 1982, Pub.L. 97-304, 96 Stat. 1426. Prior to 1982, reintroduced species were treated the same as any other endangered species. *See id.* § 1536 & 1538(a) (providing for stringent consultation and reporting requirements and a near absolute prohibition on the taking of endangered species). These strict limits led to significant local opposition to the reintroductions. In response to these problems, Congress added section 10(j), which allows the FWS to designate as "experimental" some reintroduced populations of endangered or threatened species. *Id.* § 1539(j). Under the looser standards of section 10(j), members of an experimental population are generally to be treated as threatened rather than endangered. *Id.* § 1539(j)(2)(C). This means that protective regulations may be established for their conservation. *See id.* at 1533(d). By promulgating special rules for an experimental population the Service can determine which prohibitions and exceptions shall apply. *See* 50 C.F.R. § 17.82 (1998).

A population may be designated as "experimental" only after the Service determines that it is not "essential" to the continuation of the species. *Id.* § 1539(j)(2)(B). An experimental population located on private land can be exempt from some of the more stringent requirements for endangered species. *See id.* § 1539(j)(2)(C)(i). If a population is found to be "non-essential" and is designated as "experimental," the FWS can develop "special regulations for each experimental population that will address the particular needs of that population." H.R.Rep. No. 97-567, at 34 (1982), *reprinted in* 1982 ***488** U.S.C.C.A.N. 2807, 2834. Furthermore, "there will be instances where the regulations allow for the incidental take of experimental populations." *Id.* Thus, under section 10(j), the FWS has the authority to promulgate regulations allowing the taking of experimental reintroduced populations under limited circumstances.

B.

The red wolf, *Canis rufus*, is an endangered species whose protection is at issue in this case. The red wolf was originally found throughout the southeastern United States. It was once abundant in the "riverine habitats of the southeast," and was especially numerous near the "canebrakes" that harbored large populations of swamp and marsh rabbits, the primary prey of the red wolf. 51 Fed.Reg. 41,790, 41,791 (1986). The FWS found that "the demise of the red wolf was directly related to man's activities, especially land changes, such as the drainage of

vast wetland areas for agricultural purposes ... and predator control efforts at the private, State, and Federal levels." *Id.*

Activities such as wetlands drainage, dam construction, and hunting reduced the red wolf to such meager numbers that it was listed as endangered in 1976. *See* 32 Fed.Reg. 4001 (1976). Because of the paucity of animals left in the wild, their poor physical condition, and the threats posed by inbreeding, the FWS decided to trap the remaining red wolves in the mid-1970s and place them in a captive breeding program. *See* 51 Fed.Reg. at 41,791. The breeding program anticipated the eventual reintroduction of some red wolves into the wild. *Id.*

In 1986, the FWS issued a final rule outlining a reintroduction plan for red wolves in the 120,000-acre Alligator River National Wildlife Refuge in eastern North Carolina. *See* 51 Fed.Reg. 41,790. This area was judged the ideal habitat within the red wolf's historic range. *Id.* at 41,791. Between 1987 and 1992, a total of 42 wolves were released in the Refuge. In 1993, the reintroduction program was expanded to include the release of red wolves in the Pocosin Lakes National Wildlife Refuge in Tennessee. Since reintroduction, some red wolves have wandered from federal refuges onto private property. From available data, as of February 1998 it was estimated that about 41 of the approximately 75 wolves in the wild may now reside on private land.[1]

This case raises a challenge to 50 C.F.R. § 17.84(c), a regulation governing the experimental populations of red wolves reintroduced into North Carolina and Tennessee pursuant to section 10(j). The FWS has extended the takings prohibitions of section 9(a)(1) to the experimental red wolf populations with certain exceptions. *See* 50 C.F.R. § 17.84(c) (1998). As noted above, the taking provision of section 9(a)(1) prevents landowners from harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting any endangered species. *See* 16 U.S.C. § 1532(19). However, in order to insure that other agencies and the public would accept the proposed reintroduction, the FWS relaxed the taking standards for wolves found on private land under its authority over experimental populations.

Section 17.84(c) allows a person to take red wolves on private land "*[p]rovided* that such taking is not intentional or willful, or is in defense of that person's own life or the lives of others." *Id.* § 17.84(c)(4)(i). Private landowners may also take red wolves on their property "when the wolves are in the act of killing livestock or pets, *Provided* that freshly wounded or killed livestock or pets are evident." *Id.* § 17.84(c)(4)(iii). A landowner may also "harass red wolves found on his or her property ... *Provided* that all such ***489** harassment is by methods that are not lethal or injurious to the red wolf." *Id.* § 17.84(c)(4)(iv). Finally, landowners may take red wolves after efforts by Service personnel to capture such animals have been abandoned, and such taking has been approved in writing. *Id.* § 17.84(c)(4)(v). All of these exceptions to the taking prohibition are subject to a 24-hour reporting requirement. *Id.* § 17.84(c)(4).

C.

In October 1990, plaintiff Richard Lee Mann shot a red wolf that he feared might threaten his cattle. The federal government prosecuted Mann under § 17.84(c), and Mann pled guilty. Mann's prosecution triggered some opposition to the red wolf program in the surrounding communities. After the program was in place for several years, the FWS held meetings with local governments and the public to receive feedback about the reintroductions. The Service contended that most people who commented expressed support for the program and that the reintroductions were generally supported by local, state and federal agencies, and elected officials. *See* 58 Fed.Reg. 62,086, 62,088 (1993). In addition, owners of nearly 200,000 acres of private land have permitted red wolves onto their land through agreements with the FWS. Nonetheless, Hyde and Washington Counties, and the towns of Belhaven and Roper, passed resolutions opposing the reintroduction of the wolves. The resolutions appeared to be based on the farming community's fears of prohibitions on private land use. *Id.*

In response to discontent with the reintroduction program, the North Carolina General Assembly passed a bill entitled "An Act to Allow the Trapping and Killing of Red Wolves by Owners of Private Land." The Act makes it lawful to kill a red wolf on private property if the landowner has previously requested the FWS to remove the red wolves from the property. *See* 1994 N.C. Sess. Laws Ch. 635, amended by 1995 N.C. Sess. Laws Ch. 83 (adding Beaufort and Craven Counties to the Act, which initially covered only Hyde and Washington Counties). This law facially conflicts with the federal regulation. For instance, § 17.84(c) allows the taking of red wolves "when the wolves are in the act of killing livestock or pets," when wounded or dead livestock or pets are evident and the taking is reported within 24 hours. *See* 50 C.F.R. § 17.84(c)(4)(iii). By contrast, the North Carolina statute makes it lawful to kill a red wolf on private property when the landowner "reasonably believes" that the wolf may be a threat to people or livestock and the "landowner

has previously requested the [FWS] to remove the red wolves from the landowner's property." *See* 1994 N.C. Sess. Laws Ch. 635, § 1. The government reports, however, that no actual conflicts between these laws have arisen, because there have been no contested state or federal prosecutions for unlawful takes since the North Carolina statute was enacted.

Appellants Charles Gibbs, Richard Mann, Hyde County, and Washington County filed the instant action challenging the federal government's authority to protect red wolves on private land. They seek a declaration that the anti-taking regulation, 50 C.F.R. § 17.84(c), as applied to the red wolves occupying private land in eastern North Carolina, exceeds Congress's power under the interstate Commerce Clause, U.S. Const. art. I, § 8, cl. 3 ("Congress shall have Power ... To regulate Commerce ... among the several States ..."). Appellants also seek an injunction against continued enforcement of the anti-taking regulation on non-federal land. Appellants claim that the red wolves have proven to be a "menace to citizens and animals in the Counties." They further allege that because of the federal regulatory protections surrounding the wolves, North Carolinians cannot effectively defend their property.

On cross-motions for summary judgment, the United States District Court for the Eastern District of North Carolina held that Congress's power to regulate interstate commerce includes the power to ***490** regulate conduct that might harm red wolves on private land. *See Gibbs v. Babbitt,* 31 F.Supp.2d 531 (E.D.N.C.1998). The district court found that the red wolves are "things in interstate commerce" because they have moved across state lines and their movement is followed by "tourists, academics, and scientists." *Id.* at 535. The court also found that the tourism they generate substantially affects interstate commerce. *See id.* The private landowners and North Carolina Counties now appeal.

II.

[1] We consider this case under the framework articulated by the Supreme Court in *United States v. Lopez,* 514 U.S. 549, 115 S.Ct. 1624, 131 L.Ed.2d 626 (1995), and *United States v. Morrison,* 529 U.S. 598, 120 S.Ct. 1740, 146 L.Ed.2d 658 (2000), *aff'g Brzonkala v. Virginia Polytechnic Institute and State University,* 169 F.3d 820 (4th Cir.1999). While Congress's power to pass laws under the Commerce Clause has been interpreted broadly, both *Lopez* and *Morrison* reestablish that the commerce power contains "judicially enforceable outer limits." *See Lopez,* 514 U.S. at 566, 115 S.Ct. 1624; *Morrison,* 120 S.Ct. at 1748-49. It is essential to our system of government that the commerce power not extend to effects on inter-state commerce that are so remote that we "would effectually obliterate the distinction between what is national and what is local." *National Labor Relations Board v. Jones & Laughlin Steel Corp.,* 301 U.S. 1, 37, 57 S.Ct. 615, 81 L.Ed. 893 (1937). Indeed, the judiciary has the duty to ensure that federal statutes and regulations are promulgated under one of the enumerated grants of constitutional authority. It is our further duty to independently evaluate whether "a rational basis exist[s] for concluding that a regulated activity sufficiently affect[s] interstate commerce." *Lopez,* 514 U.S. at 557, 115 S.Ct. 1624.

While this is rational basis review with teeth, the courts may not simply tear through the considered judgments of Congress. Judicial restraint is a long and honored tradition and this restraint applies to Commerce Clause adjudications. "Due respect for the decisions of a coordinate branch of Government demands that we invalidate a congressional enactment only upon a plain showing that Congress has exceeded its constitutional bounds." *Morrison,* 120 S.Ct. at 1748. In fact, "[t]he substantial element of political judgment in Commerce Clause matters leaves our institutional capacity more in doubt than when we decide cases, for instance, under the Bill of Rights." *Lopez,* 514 U.S. at 579, 115 S.Ct. 1624 (Kennedy, J., concurring). We must enforce the structural limits of Our Federalism, but we must also defer to the political judgments of Congress, recognizing that the "Commerce Clause represents a broad grant of federal authority." *Brzonkala v. Virginia Polytechnic Instit. and State Univ.,* 169 F.3d 820, 830 (4th Cir.1999), *aff'd sub nom. Morrison,* 120 S.Ct. 1740.

The *Lopez* Court recognized three broad categories of activity that Congress may regulate under its commerce power. 514 U.S. at 558, 115 S.Ct. 1624. "First, Congress may regulate the use of the channels of interstate commerce. Second, Congress is empowered to regulate and protect the instrumentalities of interstate commerce, or persons or things in interstate commerce, even though the threat may come only from intrastate activities. Finally, Congress' commerce authority includes the power to regulate those activities having a substantial relation to interstate commerce, *i.e.*, those activities that substantially affect interstate commerce." *Id.* at 558-59, 115 S.Ct. 1624 (citations omitted).

Section 17.84(c) is "not a regulation of the use of the channels of interstate commerce, nor is it an attempt to prohibit the interstate transportation of a commodity

through the channels of commerce." *Lopez,* 514 U.S. at 559, 115 S.Ct. 1624. The term "channel of interstate commerce" refers to, *inter alia,* "navigable rivers, lakes, and canals of the United States; the interstate ***491** railroad track system; the interstate highway system; ... interstate telephone and telegraph lines; air traffic routes; television and radio broadcast frequencies." *United States v. Miles,* 122 F.3d 235, 245 (5th Cir.1997). This regulation of red wolf takings on private land does not target the movement of wolves or wolf products in the channels of interstate commerce.

[2] This case also does not implicate *Lopez* 's second prong, which protects things in interstate commerce. Although the Service has transported the red wolves interstate for the purposes of study and the reintroduction programs, this is not sufficient to make the red wolf a "thing" in interstate commerce. *See, e.g., Lopez,* 514 U.S. at 559, 115 S.Ct. 1624 (rejecting application of prong two to Gun-Free School Zones Act, despite the fact that the regulated guns likely traveled through interstate commerce); *National Assoc. of Home Builders v. Babbitt,* 130 F.3d 1041, 1046 (D.C.Cir.1997) ("*NAHB* ") (rejecting notion that Delhi Sands Flower-Loving Fly was a "thing" in interstate commerce). Therefore, if 50 C.F.R. § 17.84(c) is within the commerce power, it must be sustained under the third prong of *Lopez.*

Under the third *Lopez* test, regulations have been upheld when the regulated activities "arise out of or are connected with a commercial transaction, which viewed in the aggregate, substantially affects interstate commerce." *Lopez,* 514 U.S. at 561, 115 S.Ct. 1624. In *Morrison,* the Supreme Court noted, "In every case where we have sustained federal regulation under *Wickard* 's aggregation principle, the regulated activity was of an apparent commercial character." *Morrison,* 120 S.Ct. at 1750 n. 4. The Court in *Lopez* likewise placed great emphasis on the "commercial concerns that are central to the Commerce Clause." *Lopez,* 514 U.S. at 583, 115 S.Ct. 1624 (Kennedy, J., concurring); *see also Hoffman v. Hunt,* 126 F.3d 575, 586-87 (4th Cir.1997) (noting the importance of the distinction between "the regulation of, on the one hand, those activities that are commercial or economic in nature ... and, on the other hand, those activities that are not").

[3] Although the connection to economic or commercial activity plays a central role in whether a regulation will be upheld under the Commerce Clause, economic activity must be understood in broad terms. Indeed, a cramped view of commerce would cripple a foremost federal power and in so doing would eviscerate national authority. The *Lopez* Court's characterization of the regulation of homegrown wheat in *Wickard v. Filburn,* 317 U.S. 111, 63 S.Ct. 82, 87 L.Ed. 122 (1942), as a case involving economic activity makes clear the breadth of this concept. The Court explained that "[e]ven *Wickard,* which is perhaps the most far reaching example of Commerce Clause authority over intrastate activity, involved economic activity in a way that the possession of a gun in a school zone does not." *Lopez,* 514 U.S. at 560, 115 S.Ct. 1624; *accord Morrison,* 120 S.Ct. at 1749-50. *See also Brzonkala,* 169 F.3d at 835 (explaining that the Court has a "relatively broad understanding of such [economic] activity"). In fact, our understanding of commerce may not be limited to its "18th-century" forms. *See Lopez,* 514 U.S. at 574, 115 S.Ct. 1624 (Kennedy, J., concurring). While we must enforce meaningful limits on the commerce power, we must also be mindful of the "Court's relatively generous conception of economic activity." *Brzonkala,* 169 F.3d at 835.

[4] *Lopez* and *Morrison* rest on the principle that where a federal statute has only a tenuous connection to commerce and infringes on areas of traditional state concern, the courts should not hesitate to exercise their constitutional obligation to hold that the statute exceeds an enumerated federal power. Respect for our federal system of government was integral to those decisions. *See Lopez,* 514 U.S. at 561 n. 3, 115 S.Ct. 1624; *Morrison,* 120 S.Ct. at 1754-55. Yet *Lopez* also counsels that "[w]here economic activity substantially ***492** affects interstate commerce, legislation regulating that activity will be sustained." 514 U.S. at 560, 115 S.Ct. 1624. In enforcing limits on the Congress, we must be careful not to overstep the judicial role. To strike down statutes that bear substantially upon commerce is to overstep our own authority even as we fault Congress for exceeding limits on its power. The irony of disregarding limits on ourselves in the course of enforcing limits upon others will assuredly not be lost on those who look to courts to respect restraints imposed by rules of law.

With these basic principles in mind, we consider appellants' challenge to § 17.84(c).

III.

Appellants argue that the federal government cannot limit the taking of red wolves on private land because this activity cannot be squared with any of the three categories that Congress may regulate under its commerce power. Appellants assert that 50 C.F.R. § 17.84(c) is therefore beyond the reach of congressional authority under the Commerce Clause.

[5] We disagree. It was reasonable for Congress and the Fish and Wildlife Service to conclude that § 17.84(c) regulates economic activity. The taking of red wolves implicates a variety of commercial activities and is closely connected to several interstate markets. The regulation in question is also an integral part of the overall federal scheme to protect, preserve, and rehabilitate endangered species, thereby conserving valuable wildlife resources important to the welfare of our country. Invalidating this provision would call into question the historic power of the federal government to preserve scarce resources in one locality for the future benefit of all Americans.

A.

[6] [7] To fall within Congress's commerce power, this regulation must have a "substantial relation to interstate commerce"-it must "substantially affect interstate commerce." *Lopez,* 514 U.S. at 559, 115 S.Ct. 1624. The Supreme Court recently emphasized that "in those cases where we have sustained federal regulation of intrastate activity based upon the activity's substantial effects on interstate commerce, the activity in question has been some sort of economic endeavor." *Morrison,* 120 S.Ct. at 1750-51. Intrastate activities may be subject to federal regulation if they have a "meaningful connection with [a] particular, identifiable economic enterprise or transaction." *Brzonkala,* 169 F.3d at 834. We therefore must consider whether the taking of red wolves on private land is "in any sense of the phrase, economic activity." *Morrison,* 120 S.Ct. at 1751-52.

Unlike the Violence Against Women Act (VAWA) in *Morrison* and the Gun-Free School Zones Act (GFSZA) in *Lopez,* § 17.84(c) regulates what is in a meaningful sense economic activity. The Court in *Morrison* explained that both the VAWA and the GFSZA involved activity that was noneconomic and only tenuously linked to interstate commerce. 120 S.Ct. at 1749-52. Yet the taking of a red wolf on private land is unlike gender-motivated violence or guns near schools. The protection of commercial and economic assets is a primary reason for taking the wolves. Farmers and ranchers take wolves mainly because they are concerned that the animals pose a risk to commercially valuable livestock and crops. Indeed, appellants' arguments focus quite explicitly on these economic concerns-they want freer rein to protect their property and investments in the land. *See* Appellants' Br. at 10 ("In the face of these threats [from red wolves], North Carolinians cannot effectively defend their property."); *id.* at 12.

[8] The relationship between red wolf takings and interstate commerce is quite direct-with no red wolves, there will be no red wolf related tourism, no scientific research, and no commercial trade in pelts. We need not "pile inference upon inference," ***493** *Lopez,* 514 U.S. at 567, 115 S.Ct. 1624, to reach this conclusion. While a beleaguered species may not presently have the economic impact of a large commercial enterprise, its eradication nonetheless would have a substantial effect on interstate commerce. And through preservation the impact of an endangered species on commerce will only increase.[2]

[9] Because the taking of red wolves can be seen as economic activity in the sense considered by *Lopez* and *Morrison,* the individual takings may be aggregated for the purpose of Commerce Clause analysis. *See Morrison,* 120 S.Ct. at 1750 n. 4. While the taking of one red wolf on private land may not be "substantial," the takings of red wolves in the aggregate have a sufficient impact on interstate commerce to uphold this regulation. This is especially so where, as here, the regulation is but one part of the broader scheme of endangered species legislation.

[10] [11] Further, § 17.84(c) is closely connected to a variety of interstate economic activities.[3] Whether the impact of red wolf takings on any one of these activities qualifies as a substantial effect on interstate commerce is something we need not address. We have no doubt that the effect of the takings on these varied activities in combination qualifies as a substantial one. The first nexus between the challenged regulation and interstate commerce is tourism. The red wolves are part of a $29.2 billion national wildlife-related recreational industry that involves tourism and interstate travel. *See Heart of Atlanta Motel,* 379 U.S. at 256, 85 S.Ct. 348 (finding it is well-established that "[c]ommerce among the States ... consists of intercourse and traffic between their citizens" (internal quotation marks omitted)). Many tourists travel to North Carolina from throughout the country for "howling events"-evenings of listening to wolf howls accompanied by educational programs. These howlings are a regular occurrence at the Alligator River National Wildlife Refuge. According to a study conducted by Dr. William E. Rosen of Cornell University, the recovery of the red wolf and increased visitor activities could result in a significant regional economic impact. *See* William E. Rosen, Red Wolf Recovery in Northeastern North Carolina ***494** and the Great Smoky Mountains National Park: Public Attitudes and Economic Impacts (unpublished, Joint Appendix at 633). Rosen estimates that northeastern North Carolina could see an increase of between $39.61 and $183.65 million per year in

tourism-related activities, and that the Great Smoky Mountains National Park could see an increase of between $132.09 and $354.50 million per year. This is hardly a trivial impact on interstate commerce. Appellants understandably seek to criticize the Rosen study, but concede that the howling events attract interstate tourism and that red wolf program volunteers come from all around the country.

[12] Appellants argue that the tourism rationale relates only to howling events on national park land or wildlife refuges because people do not travel to private land. They reason that without tourism on private land the regulated activity does not substantially affect interstate commerce. Yet this argument misses the mark. Since reintroduction, red wolves have strayed from federal lands onto private lands. Indeed, wolves are known to be "great wanderers." *See* 60 Fed.Reg. 18,940, 18,943 (1995). In 1998, it was estimated that 41 of the 75 wolves in the wild now live on private land. Because so many members of this threatened species wander on private land, the regulation of takings on private land is essential to the entire program of reintroduction and eventual restoration of the species. Such regulation is necessary to conserve enough red wolves to sustain tourism. Appellants in fact seem unmindful of the history of endangered species regulation. The Endangered Species Acts of 1966 and 1969 initially targeted conservation efforts only on federal lands, but they met with limited success. *See* Note, *Evolution of Wildlife Legislation in the United States: An Analysis of the Legal Efforts to Protect Endangered Species and the Prospects for the Future,* 5 Geo. Int'l Envtl. L.Rev. 441, 449-53 (1993). The Endangered Species Act of 1973 was motivated in part by the need to extend takings regulation beyond the limited confines of federal land. *See id.* at 556. The prohibition of takings on private land was critical to the overall success of the ESA in halting and reversing the near extinction of numerous species. *See* 16 U.S.C. § 1538(a)(1). The success of many commercial enterprises depends on some regulation of activity on private land, and interstate tourism is no exception.

Tourism, however, is not the only interstate commercial activity affected by the taking of red wolves. The regulation of red wolf takings is also closely connected to a second interstate market-scientific research. Scientific research generates jobs. It also deepens our knowledge of the world in which we live. The red wolf reintroduction program has already generated numerous scientific studies. For example, the red wolf is used as a model for other carnivore reintroductions. *See* Donald E. Moore III & Roland Smith, *The Red Wolf as a Model for Carnivore Reintroductions,* 62 Symp. Zool. Soc. Lond. 263 (1990). Scientists have also studied how the red wolf affects small mammal populations and how the wolves interact with the ecosystem as a whole. *See, e.g.,* Bryan T. Kelly, Alligator River National Wildlife Refuge Red Wolf (*Canis Rufus*) Scat Analysis: Preliminary Analyses of Mammalian Prey Consumed by Year, Season, Pack, Sex, and Age (April 1994) (unpublished, Joint Appendix at 942). By studying the effects of red wolves on the ecosystem, scientists learn about the interdependence of plants and animals, as well as how other threatened species may be reintroduced in the future. Scientific research can also reveal other uses for animals-for instance, approximately 50 percent of all modern medicines are derived from wild plants or animals. *See* Norman Myers, *A Wealth of Wild Species: Storehouse for Human Welfare* 4 (1983). Protection of the red wolves on private land thus encourages further research that may have inestimable future value, both for scientific knowledge as well as for commercial development of the red wolf.

***495** The anti-taking regulation is also connected to a third market-the possibility of a renewed trade in fur pelts. Wolves have historically been hunted for their pelts. *See* Stanley P. Young & Edward A. Goldman, *The Wolves of North America* I, 165-70 (1964). Congress had the renewal of trade in mind when it enacted the ESA. The Senate Report noted that the protection of an endangered species "may permit the regeneration of that species to a level where controlled exploitation of that species can be resumed. In such a case businessmen may profit from the trading and marketing of that species for an indefinite number of years, where otherwise it would have been completely eliminated from commercial channels." S.Rep. No. 91-526, at 3 (1969), *reprinted in* 1969 U.S.C.C.A.N. 1413, 1415. The American alligator is a case in point. In 1975, the American alligator was nearing extinction and listed as endangered, but by 1987 conservation efforts restored the species. Now there is a vigorous trade in alligator hides. *See* Catharine L. Krieps, *Sustainable Use of Endangered Species Under CITES: Is it a Sustainable Alternative?,* 17 U. Pa. J. Int'l Econ. L. 461, 479-80 (1996) (explaining that many environmentalists are now encouraging the purchase of alligator products to create an incentive for protecting alligators and their habitats). Although alligator hides have more recently been a part of interstate commercial trade and red wolves were sold for their pelts primarily in the nineteenth century, this temporal difference is beside the point. It is not for the judiciary to move from species to species, opining that species A possesses great commercial potential, but species B does not. Assessing the relative scientific value and commercial impact of alligators and red wolves is for Congress and the FWS, informed as they are by biologists, economists, and others whose expertise is best delivered to the political branches,

not the courts.

[13] Finally, the taking of red wolves is connected to interstate markets for agricultural products and livestock. For instance, appellant landowners find red wolves a menace because they threaten livestock and other animals of economic and commercial value. By restricting the taking of red wolves, § 17.84(c) is said to impede economic development and commercial activities such as ranching and farming. This effect on commerce, however, still qualifies as a legitimate subject for regulation. It is well-settled under Commerce Clause cases that a regulation can involve the promotion or the restriction of commercial enterprises and development. Indeed, "[t]he motive and purpose of a regulation of interstate commerce are matters for the legislative judgment." *United States v. Darby,* 312 U.S. 100, 115, 61 S.Ct. 451, 85 L.Ed. 609 (1941). We recognize that "Congress can regulate interstate commerce for any lawful motive." *United States v. Soderna,* 82 F.3d 1370, 1374 (7th Cir.1996). The regulation here targets takings that are economically motivated-farmers take wolves to protect valuable livestock and crops. It is for Congress, not the courts, to balance economic effects-namely whether the negative effects on interstate commerce from red wolf predation are outweighed by the benefits to commerce from a restoration of this species. To say that courts are ill-suited for this act of empirical and political judgment is an understatement.

[14] It is anything but clear, for example, that red wolves harm farming enterprises. They may in fact help them, and in so doing confer additional benefits on commerce. For instance, red wolves prey on animals like raccoons, deer, and rabbits-helping farmers by killing the animals that destroy their crops. *See* Robert J. Esher & Theodore R. Simons, Red Wolf Propagation on Horn Island, Miss.: Red Wolf Ecological Studies 13-16 (Sept.1993) (unpublished, Joint Appendix at 890). On Horn Island, for instance, researchers found evidence of increased shore bird nesting, likely due to the reduction in raccoon predation. *See id.* at 15. In *Tennessee Valley Authority v. Hill ("TVA"),* the Supreme Court recognized that one of ***496** Congress's primary concerns in enacting the ESA was "the *unknown* uses that endangered species might have and about the *unforeseeable* place such creatures may have in the chain of life on this planet." 437 U.S. 153, 178-79, 98 S.Ct. 2279, 57 L.Ed.2d 117 (1978). It is within the power of Congress to regulate the coexistence of commercial activity and endangered wildlife in our nation and to manage the interdependence of endangered animals and plants in large ecosystems. It is irrelevant whether judges agree or disagree with congressional judgments in this contentious area. Given the existing economic and commercial activity involving red wolves and wildlife generally, Congress could find that conservation of endangered species and economic growth are mutually reinforcing. It is simply not beyond the power of Congress to conclude that a healthy environment actually boosts industry by allowing commercial development of our natural resources.

Section 17.84(c) aims to reverse threatened extinction and conserve the red wolf for both current and future use in interstate commerce. Congress is entitled to make the judgment that conservation is potentially valuable, even if that value cannot be presently ascertained. The Supreme Court has held that the congressional decision to maintain abandoned railroad track is reasonable "even if no future rail use for it is currently foreseeable." *Preseault v. ICC,* 494 U.S. 1, 19, 110 S.Ct. 914, 108 L.Ed.2d 1 (1990). The Court reasoned that "[g]iven the long tradition of congressional regulation of railroad abandonments, that is a judgment that Congress is entitled to make." *Id.* (citations omitted). Similarly, Congress has long been involved in the regulation of scarce and vital natural resources. The full payoff of conservation in the form of tourism, research, and trade may not be foreseeable. Yet it is reasonable for Congress to decide that conservation of species will one day produce a substantial commercial benefit to this country and that failure to preserve a species will result in permanent, though unascertainable, commercial loss.

When enacting the ESA, various legislators expressed these exact concerns, namely that species be conserved for future scientific development:

> The value of this genetic heritage is, quite literally, incalculable.... From the most narrow possible point of view, it is in the best interests of mankind to minimize the losses of genetic variations. The reason is simple: they are potential resources.... Who knows, or can say, what potential cures for cancer or other scourges, present or future, may lie locked up in the structures of plants which may yet be undiscovered, much less analyzed? ... Sheer self-interest impels us to be cautious.

H.R.Rep. No. 93-412, at 4-5 (1973). Extinction, after all, is irreversible. If a species becomes extinct, we are left to speculate forever on what we might have learned or what we may have realized. If we conserve the species, it will

be available for the study and benefit of future generations. In any event, it is for Congress to choose between inaction and preservation, not for the courts.

Courts have uniformly upheld endangered species legislation after *Lopez* based on many of the same current and future connections to interstate commerce articulated here. In fact, no case has been brought to our attention that invalidates any endangered species regulation for exceeding the commerce power. In addressing a post-*Lopez* challenge to the constitutionality of the Bald Eagle Protection Act, 16 U.S.C. § 668 (1994), the Ninth Circuit found that "[e]xtinction of the eagle would substantially affect interstate commerce by foreclosing any possibility of several types of commercial activity: future commerce in eagles or their parts; future interstate travel for the purpose of observing or studying eagles; or future commerce in beneficial products derived either from eagles or from analysis of their genetic material." ***497** *United States v. Bramble,* 103 F.3d 1475, 1481 (9th Cir.1996). Similarly, "[g]iven the interconnectedness of species and ecosystems, it is reasonable to conclude that the extinction of one species affects others and their ecosystems and that the protection of a purely intrastate species ... will therefore substantially affect land and objects that are involved in interstate commerce." *See NAHB,* 130 F.3d at 1059 (Henderson, J., concurring). In addition, the District of Columbia District Court upheld application of the ESA to the fairy shrimp, a severely endangered species limited to one state. *See Building Indus. Assoc. of Superior Cal. v. Babbitt,* 979 F.Supp. 893 (D.D.C.1997). The court declined to "read *Lopez* as hamstringing Congress in such an irrational fashion in a regulatory area of such important economic, scientific and environmental dimensions." *Id.* at 908. Pre-*Lopez* cases reached similar results. *See, e.g., Hoffman Homes, Inc. v. Administrator,* 999 F.2d 256, 261 (7th Cir.1993); *Palila v. Hawaii Dep't of Land and Natural Resources,* 471 F.Supp. 985, 995 (D.Haw.1979), *aff'd,* 639 F.2d 495 (9th Cir.1981).

The protection of the red wolf on both federal and private land substantially affects interstate commerce through tourism, trade, scientific research, and other potential economic activities. To overturn this regulation would start courts down the road to second-guessing all kinds of legislative judgments. There is a "rational basis" as defined by *Lopez* for sustaining this regulation. We therefore hold that the anti-taking provision at issue here involves regulable economic and commercial activity as understood by current Commerce Clause jurisprudence.[4]

B.

This regulation is also sustainable as "an essential part of a larger regulation of economic activity, in which the regulatory scheme could be undercut unless the intrastate activity were regulated." *Lopez,* 514 U.S. at 561, 115 S.Ct. 1624. The Supreme Court in *Hodel v. Indiana* stated: "A complex regulatory program ... can survive a Commerce Clause challenge without a showing that every single facet of the program is independently and directly related to a valid congressional goal. It is enough that the challenged provisions are an integral part of the regulatory program and that the regulatory scheme when considered as a whole satisfies this test." 452 U.S. 314, 329 n. 17, 101 S.Ct. 2376, 69 L.Ed.2d 40 (1981).

The FWS issued this regulation pursuant to the provisions of the Endangered Species Act, a comprehensive and far-reaching piece of legislation that aims to conserve the health of our national environment. Congress undoubtedly has the constitutional authority to pass legislation for the conservation of endangered species. *See Babbitt v. Sweet Home Chapter of Communities for a Great Or.,* 515 U.S. 687, 115 S.Ct. 2407, 132 L.Ed.2d 597 (1995) (presupposing validity of Endangered Species Act in upholding broad definition of "harm" as including significant habitat modification); *see also TVA v. Hill,* 437 U.S. at 194, 98 S.Ct. 2279 (emphasizing that Congress has struck a balance in "favor of affording endangered species the highest of priorities" and upholding application of the ESA because "[o]nce the meaning of an enactment is discerned and its constitutionality determined, the judicial process comes to an end").

[15] Appellants repeatedly argue that individual takings of red wolves have only an insubstantial effect on interstate commerce and therefore that the application of the regulation to private landowners is invalid. But we emphasize that the effect on commerce must be viewed not from the taking of one wolf, but from the potential commercial differential between an extinct and a recovered species. A single red ***498** wolf taking may be insubstantial by some measures, but that does not invalidate a regulation that is part of the ESA and that seeks conservation not only of any single animal, but also recovery of the species as a whole. The Supreme Court in *Lopez* was emphatic on this point: " 'where *a general regulatory statute bears a substantial relation to commerce,* the *de minimis* character of individual instances arising under that statute is of no consequence.' " 514 U.S. at 558, 115 S.Ct. 1624 (alteration in original) (quoting *Maryland v. Wirtz,* 392 U.S. 183, 197 n. 27, 88 S.Ct. 2017, 20 L.Ed.2d 1020 (1968)); *see also Perez v. United States,* 402 U.S. 146, 154, 91 S.Ct. 1357, 28 L.Ed.2d 686 (1971) ("Where the *class of activities* is

regulated and that *class* is within the reach of federal power, the courts have no power to excise, as trivial, individual instances of the class." (internal quotation marks omitted)).

Once a species has been designated as endangered, there are by definition only a few remaining animals. Therefore, the effects on interstate commerce should not be viewed from the arguably small commercial effect of one local taking, but rather from the effect that single takings multiplied would have on advancing the extinction of a species. Each taking impacts the overall red wolf population, which has an effect on many dimensions of commerce between the states. As the Supreme Court has stated, "[i]f it is interstate commerce that feels the pinch, it does not matter how local the operation which applies the squeeze." *Heart of Atlanta Motel,* 379 U.S. at 258, 85 S.Ct. 348 (internal quotation marks omitted). Section 17.84(c) must thus be evaluated against the overall congressional goal of restoring red wolves and endangered species generally. It would be perverse indeed if a species nearing extinction were found to be beyond Congress's power to protect while abundant species were subject to full federal regulatory power. Yet under appellants' theory, the more endangered the species, the less authority Congress has to regulate the taking of it. According to this view, endangered species would lie beyond congressional protection because there are too few animals left to make a commercial difference. Such reasoning would eviscerate the comprehensive federal scheme for conserving endangered species and turn congressional judgment on its head.

[16] Appellants protest they do not ask us to overturn the ESA. They simply want us to excise as unconstitutional a disfavored provision that places a strain on their agricultural activities. But given that Congress has the ability to enact a broad scheme for the conservation of endangered species, it is not for the courts to invalidate individual regulations. If appellants think this regulation unwise, they must make their plea to Congress. The judiciary lacks the delegated powers of the FWS or the Environmental Protection Agency. Separation of powers principles mandate that we leave decisions such as these to Congress and to agencies with congressionally sanctioned expertise and authority. The Supreme Court itself has been mindful of the "degree of regulatory expertise necessary to [the ESA's] enforcement." *Sweet Home,* 515 U.S. at 703, 115 S.Ct. 2407. Lacking such expertise, we must decide not whether the regulation meets with judicial favor, but whether it passes constitutional muster.

The specific needs of individual species, as well as the balance to be struck with landowners in or near the species' habitats, present a classic case for legislative balancing. Here § 17.84(c) was promulgated precisely so that private landowners could take red wolves under certain circumstances. For instance, subject to certain reporting requirements, landowners can "take" wolves in self-defense, *see* 50 C.F.R. § 17.84(c)(4)(i), or when the wolves are found in the act of killing livestock or pets, *see id.* § 17.84(c)(4)(iii). Landowners can also harass wolves found on private property, provided that harassment is by methods that are not lethal or physically injurious to the red wolf, *see id.* § 17.84(c)(4)(iv). ***499** These provisions may ease tensions between the red wolves and private landowners. Without these special regulations, all red wolves would be subject to the absolute taking prohibition of section 9(a), placing a much greater burden on the property owner. Congress and the Service have decided that these experimental wolves can be taken under certain circumstances based on an evaluation of competing interests. How these lines should be drawn and this balance struck is grist for the legislative and administrative mill and beyond the scope of judicial competence.

IV.

Upholding this regulation is consistent with the "first principles" of a Constitution that establishes a federal government of enumerated powers. *See Lopez,* 514 U.S. at 552, 115 S.Ct. 1624. *Lopez* and *Morrison* properly emphasize that we must carefully evaluate legislation in light of our federal system of government. "The Constitution requires a distinction between what is truly national and what is truly local." *Morrison,* 120 S.Ct. at 1754-55. We must particularly scrutinize regulated activity that "falls within an area of the law where States historically have been sovereign and countenance of the asserted federal power would blur the boundaries between the spheres of federal and state authority." *Brzonkala,* 169 F.3d at 837 (internal quotation marks omitted).

A.

[17] It is imperative to set forth at the outset the historic roles of federal and state authority in this area. The regulated activity at issue here does not involve an "area of traditional state concern," one to which "States lay claim by right of history and expertise." *Lopez,* 514 U.S. at 580, 583, 115 S.Ct. 1624 (Kennedy, J., concurring).

Appellants argue that the regulation infringes on the traditional state control over wildlife. We are cognizant that states play a most important role in regulating wildlife-many comprehensive state hunting and fishing laws attest to it. State control over wildlife, however, is circumscribed by federal regulatory power. In *Minnesota v. Mille Lacs Band of Chippewa Indians,* the Supreme Court recently reiterated that "[a]lthough States have important interests in regulating wildlife and natural resources within their borders, this authority is shared with the Federal Government when the Federal Government exercises one of its enumerated constitutional powers." 526 U.S. 172, 204, 119 S.Ct. 1187, 143 L.Ed.2d 270 (1999). In *Mille Lacs,* the Court upheld Chippewa Indian rights under an 1837 treaty that allowed the Chippewa to hunt, fish, and gather free of territorial, and later state, regulation. *Id.* These Indian treaty rights were found to be "reconcilable with state sovereignty over natural resources." *Id.* at 205, 119 S.Ct. 1187.

It is true that in the nineteenth century courts followed the legal precept that wildlife was the property of the state. *See Geer v. Connecticut,* 161 U.S. 519, 16 S.Ct. 600, 40 L.Ed. 793 (1896) (upholding a Connecticut statute that prohibited the interstate transportation of game birds that had been killed within the state). But the principles in *Geer* were modified early in the twentieth century. *See Hughes v. Oklahoma,* 441 U.S. 322, 329, 99 S.Ct. 1727, 60 L.Ed.2d 250 (1979) ("The erosion of *Geer* began only 15 years after it was decided."). *Geer* was finally overruled in 1979 by *Hughes v. Oklahoma,* which held that states do not own the wildlife within their borders and that state laws regulating wildlife are circumscribed by Congress's commerce power. 441 U.S. at 326, 335, 99 S.Ct. 1727. In light of *Mille Lacs* and *Hughes,* the activity regulated by § 17.84(c)-the taking of red wolves on private property-is not an area in which the states may assert an exclusive and traditional prerogative in derogation of an enumerated federal power.

[18] Appellants next argue that the application of this regulation to private land intrudes on the state's traditional police power to regulate local land use. Of ***500** course, states and localities possess broad regulatory and zoning authority over land within their jurisdictions. *See Village of Euclid v. Ambler Realty Co.,* 272 U.S. 365, 47 S.Ct. 114, 71 L.Ed. 303 (1926). It is well established, however, that Congress can regulate even private land use for environmental and wildlife conservation. Courts have consistently upheld Congress's authority to regulate private activities in order to conserve species and protect the environment. For example, in a post-*Lopez* challenge to CERCLA, the Eleventh Circuit held that the private, on-site, intrastate disposal of hazardous waste was within Congress's authority to regulate because such disposal "significantly impacts interstate commerce." *United States v. Olin Corp.,* 107 F.3d 1506, 1510 (11th Cir.1997). In *Sweet Home,* the Supreme Court upheld a FWS regulation defining "harm" in the Endangered Species Act to include "significant habitat modification." 515 U.S. at 697, 115 S.Ct. 2407. The regulation applied equally to private and public land. *See id.* at 692, 115 S.Ct. 2407 (challenge brought by small landowners and logging companies). Here, the FWS similarly acted within its authority in determining that conservation of the red wolf population requires prohibiting certain takings on private land surrounding the refuges. *See* 51 Fed.Reg. 41,790, 41,792-93 (1986).

Given the history of federal regulation over wildlife and related environmental concerns, it is hard to imagine how this anti-taking regulation trespasses impermissibly upon traditional state functions-either control over wildlife or local land use. *Lopez* and *Morrison* properly caution that States should receive judicial protection from unconstitutional federal encroachments on state matters. Yet endangered wildlife regulation has not been an exclusive or primary state function. In this way the anti-taking regulation is distinctly unlike the GFSZA, which forbade the possession of firearms in a school zone. The Supreme Court explained that the regulation of school zones was within the "general police power" retained by the states. *See Lopez,* 514 U.S. at 567, 115 S.Ct. 1624. The regulation of red wolf taking is also unlike the VAWA, which established a "right to be free from crimes of violence motivated by gender," 42 U.S.C. § 13981(b) (1994). The Supreme Court found that the VAWA impeded on family law and criminal matters of traditional state concern. *See Morrison,* 120 S.Ct. at 1754-55. The Court noted, "[W]e can think of no better example of the police power, which the Founders denied the National Government and reposed in the States, than the suppression of violent crime and vindication of its victims." *Id.* at 1754. Unlike the GFSZA and the VAWA, § 17.84(c) does not invade traditional state concerns-it is simply one small part of an ongoing federal effort to preserve the scarcest natural resources for future generations.

In contrast to gender-motivated violence or guns in school yards, the conservation of scarce natural resources is an appropriate and well-recognized area of federal regulation. The federal government has been involved in a variety of conservation efforts since the beginning of this century. In 1900, Congress passed the Lacey Act, which provided penalties for the taking of wildlife in violation of

state laws. *See* Act of May 25, 1900, ch. 553, 31 Stat. 187 (codified as amended 16 U.S.C. § 701 (1994)). The Migratory Bird Treaty Act of 1918 forbade all takings of numerous bird species and explicitly preempted state laws. *See* 16 U.S.C. §§ 703-12. Furthermore, Congress has regulated wildlife on nonfederal property through numerous statutes, including the Bald Eagle Protection Act of 1940, which prohibits, *inter alia,* the taking, possession, selling, or exporting of bald eagles or any of their parts. *See* 16 U.S.C. §§ 668-668d (1994). Similarly, the Marine Mammal Protection Act of 1972 regulates the taking of marine mammals and restricts the importing of marine mammals and their products through an elaborate system of permits. *See* 16 U.S.C. §§ 1361-1421h (1994 & Supp. III 1997). The Magnuson Fishery ***501** Conservation and Management Act of 1976 provides national standards for fishery conservation and management along with an elaborate system of enforcement. *See* 16 U.S.C. §§ 1801-83 (1994 & Supp. III 1997).

The Supreme Court has repeatedly upheld these statutes and the conservation efforts of Congress with regard to a variety of animal species. In *Missouri v. Holland,* the Court upheld the Migratory Bird Treaty Act as a necessary and proper means of executing Congress's treaty power. The conservation of endangered wildlife, Justice Holmes stated, was a "matter[ ] of the sharpest exigency for national well being." 252 U.S. 416, 432-33, 40 S.Ct. 382, 64 L.Ed. 641 (1920). In 1977, the Supreme Court held that Congress had the power under the Commerce Clause to grant federal fishing licenses for use in state waters, thereby preempting conflicting state laws. *See Douglas v. Seacoast Products, Inc.,* 431 U.S. 265, 97 S.Ct. 1740, 52 L.Ed.2d 304 (1977). Later in *Andrus v. Allard,* the Court emphasized that the "assumption that the national commerce power does not reach migratory wildlife is clearly flawed." 444 U.S. 51, 63 n. 19, 100 S.Ct. 318, 62 L.Ed.2d 210 (1979).

Post-*Lopez* cases addressing wildlife conservation statutes do not call these cases into question, but rather uphold the exercise of agency power over private land use in order to conserve endangered species. In *Sweet Home,* for example, the Court upheld the Service's broad definition of "harm" in the ESA as including "significant habitat modification." 515 U.S. at 708, 115 S.Ct. 2407. The lower courts have followed suit, both before and after *Lopez.* For example, in *United States v. Hartsell,* this court reaffirmed that Congress retains authority to regulate even non-navigable waters under the Commerce Clause. 127 F.3d 343, 348 & n. 1 (4th Cir.1997). The Ninth Circuit reaffirmed that the Bald Eagle Protection Act is a valid exercise of the commerce power because Congress had a rational basis for concluding that "extinction of the eagle would have a substantial effect on interstate commerce." *See Bramble,* 103 F.3d at 1482. In sum, it is clear from our laws and precedent that federal regulation of endangered wildlife does not trench impermissibly upon state powers. Rather, the federal government possesses a historic interest in such regulation-an interest that has repeatedly been recognized by the federal courts.

B.

It is important not simply to point to the historic fact of federal efforts in the area of resource conservation. Courts have respected the justifications for these federal efforts as well.

The Supreme Court has recognized that protection of natural resources may require action from Congress. This general point holds true where endangered species are concerned. Species conservation may unfortunately impose additional costs on private concerns. States may decide to forego or limit conservation efforts in order to lower these costs, and other states may be forced to follow suit in order to compete. The Supreme Court has held that Congress may take cognizance of this dynamic and arrest the "race to the bottom" in order to prevent interstate competition whose overall effect would damage the quality of the national environment. In *Hodel v. Virginia Surface Mining and Reclamation Ass'n,* the Court upheld provisions of the Surface Mining Control and Reclamation Act of 1977 that regulated intrastate mining activities. 452 U.S. 264, 101 S.Ct. 2352, 69 L.Ed.2d 1 (1981). The Court deferred to a congressional finding that nationwide standards were "essential" to insuring that competition in interstate commerce among sellers of coal would not be used to undermine environmental standards. *See id.* at 281-82, 101 S.Ct. 2352. Congress expressed concern that such competition would disable states from improving and maintaining "adequate standards on coal mining operations within their borders." *Id.* (internal quotation marks omitted). The Court emphasized, ***502** "The prevention of this sort of destructive interstate competition is a traditional role for congressional action under the Commerce Clause." *Id.* at 282, 101 S.Ct. 2352. In *Darby,* the Court upheld a prohibition of the interstate shipment of goods produced in violation of the Fair Labor Standards Act. 312 U.S. 100, 61 S.Ct. 451, 85 L.Ed. 609. The Court reasoned that "interstate commerce should not be made the instrument of competition in the distribution of goods produced under substandard labor conditions." *Id.* at 115, 61 S.Ct. 451.

A desire for uniform standards also spurred enactment of the ESA: "[P]rotection of endangered species is not a matter that can be handled in the absence of coherent national and international policies: the results of a series of unconnected and disorganized policies and programs by various states might well be confusion compounded." *See* H.R.Rep. No. 93-415, at 5. If we struck down this regulation under the commerce power, we would throw into question much federal environmental legislation. This would be a portentous step, leaving many environmental harms to be dealt with through state tort law. Such a movement might well subject interstate companies to a welter of conflicting obligations. If Congress is constitutionally forbidden from even enacting uniform environmental rules, the confusion for interstate commercial enterprises might increase exponentially.

In examining the justifications for federal action in this area it is important to understand the ESA as a culmination of a long legislative process of trial and error. This font of experience is something courts lack. As we noted earlier, preliminary efforts at endangered species regulation were widely viewed as inadequate precisely because they did not control private activities. The Endangered Species Act of 1966 established a National Wildlife Refuge System and prohibited disturbing animals or habitat within the System. *See* Pub.L. No. 89-669, § 4, 80 Stat. 926. The Endangered Species Act of 1969 required the Secretary of the Interior to develop a list of endangered species, and prohibited the importation of these animals or any of their by-products without a permit. *See* Pub.L. No. 91-135, § 3(a), § 2, 83 Stat. 275. These statutes also required federal agencies to conserve species "insofar as is practicable," § 1(b), 80 Stat. at 926, and to the "extent practicable," § 3(a), 83 Stat. at 275. In response to concerns that these Acts had little impact, Congress amended the ESA in 1973 to abandon the practicability standards and to prohibit takings on private land. *See* 16 U.S.C. § 1538. According to the General Accounting Office, in 1993 there were 781 species listed under the ESA-over 90 percent of these species have some or all of their habitat on nonfederal lands. Nearly three-fourths of the listed species had over 60 percent of their habitat on nonfederal lands. Courts cannot simply ignore or negate congressional efforts to devise a more effective solution to a significant national problem.

C.

This regulation does not blur the boundaries between federal and state responsibility for the conservation of species. Disturbing the balance of federal and state power was a primary concern in both *Lopez* and *Morrison.* In *Lopez,* Justice Kennedy argued that one of the great dangers of the federal government regulating areas of traditional state concern is that "the boundaries between the spheres of federal and state authority would blur and political responsibility would become illusory." 514 U.S. at 577, 115 S.Ct. 1624 (Kennedy, J., concurring). In *Brzonkala* this court observed that because the VAWA supplemented and interfered with state remedies, "the citizens of the States[would] not know which sovereign to hold accountable for any failure to address adequately gender-motivated crimes of violence." 169 F.3d at 842.

Section 17.84(c) is distinguishable from both the GFSZA and the VAWA because the ultimate responsibility for the red wolf lies with the federal government. The regulation outlines the responsibilities and ***503** obligations of landowners with regard to any red wolves on their property. *See* 50 C.F.R. § 17.84(c). The FWS has also distributed fact sheets about the wolves and held meetings with local residents to explain the regulation and the reintroduction. From the time of reintroduction until 1994, North Carolina had no law or regulation concerning the red wolf. A recently passed North Carolina law bears a title starkly at odds with the federal regulation: "An Act to Allow the Trapping and Killing of Red Wolves by Owners of Private Land." 1994 N.C. Sess. Laws Ch. 635. Unlike the GFSZA and the VAWA, § 17.84(c) does not duplicate or supplement state and local regulation. Quite to the contrary, it simply provides federal support for an endangered species. The dangers of blurring are minimal where the federal role in the protection of endangered species has traditionally been so clear.

Congress, however, did not simply sweep away the role of the states by enacting a national solution to the problem of red wolf conservation. The ESA and § 17.84(c) embody principles of cooperative federalism and seek to involve the states in the conservation effort. Such cooperative federalism does not blur state and federal roles. First, a species is listed as endangered or threatened only after reviewing "those efforts, if any, being made by any State ... to protect such species." 16 U.S.C. § 1533(b)(1)(A). Second, once the species has recovered and is "delisted," management responsibility will return to the states. *See id.* § 1532(3) (defining "conservation" as "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this chapter are no longer necessary"). States can then regulate the species for hunting and resource management as it sees fit. For instance, in Minnesota, citizens have expressed interest in hunting the grey wolf,

which is expected to be delisted soon and its management returned to the state. *See Feds Again Delay Wolf Management Plan: Officials Had to Do Some Rework After Legislature Failed to Pass State Plan,* Star-Tribune (Minneapolis), Nov. 29, 1999, at B7 (explaining that wolf numbers were strong enough to drop federal protection, but that the Minnesota legislature failed to pass a management plan for the wolves). Indeed, there is evidence that the recovery of the red wolf could allow a renewed trade in wolf pelts. For example, in the Northwestern Territories of Canada where wolves are plentiful, a hunter can command about $300 per pelt. *See* Fred Langan, *Hunters on Snowmobiles Cut Down Wolf Count in N.W.T.,* Calgary Herald, Mar. 3, 1998, at A7.

This regulation simply does not implicate any "immediate and concrete" federalism concerns by negating state contributions to species protection. *Brzonkala,* 169 F.3d at 840. Quite to the contrary, invalidating this regulation would deal a damaging blow to the essential place of the enumerated powers in preserving scarce resources of all sorts for the common good.

D.

Unlike the statutes in *Lopez* and *Brzonkala,* § 17.84(c) can be upheld while observing principled limitations on federal power. The regulation applies only to a single limited area-endangered species. It does not in any way grant Congress "an unlimited police power inconsistent with a Constitution of enumerated and limited federal powers." *Brzonkala,* 169 F.3d at 852. Nor does the regulation "obliterate the Constitution's distinction between national and local authority." *Morrison,* 120 S.Ct. at 1752. In *Lopez,* the Court rejected the "costs of crime" and "national productivity" justifications for the GFSZA, because under these theories it was "difficult to perceive any limitation on federal power, even in areas such as criminal law enforcement or education where States historically have been sovereign." 514 U.S. at 564, 115 S.Ct. 1624.

But these concerns are simply not implicated by § 17.84(c). Rather, the ESA and ***504** this regulation in particular permit the exercise of federal power only to conserve those species that are "endangered" or "threatened." The Secretary must determine whether a species is endangered or threatened "solely on the basis of the best scientific and commercial data available to him after conducting a review of the status of the species." 16 U.S.C. § 1533(b)(1)(A). Only after determining that a species is endangered or threatened can Congress regulate it. The rationale for upholding § 17.84(c), and the ESA generally, is restricted to the special relationship between endangered species and interstate commerce as drawn in Part III. It is not a connection that can be drawn outside of the endangered species context to support federal regulation of just any local or intrastate object with a medical, scientific, or economic value.

The rationale for this regulation thus stops far short of conferring upon Congress a broad police power. It is instead appellants' arguments for invalidating this regulation that go too far. If the federal government cannot regulate the taking of an endangered or threatened species on private land, its conservation and preservation efforts would be limited to only federal lands. A ruling to this effect would place in peril the entire federal regulatory scheme for wildlife and natural resource conservation.

V.

Finally, we offer a brief response to the views of our dissenting brother. According to the dissent, *Lopez* and *Morrison* require us to hold that the regulation at issue exceeds Congress's commerce power. We cannot accept this view. To invalidate this regulation would require courts to move abruptly from preserving traditional state roles to dismantling historic federal ones.

The dissenting opinion regrettably offers no legal basis for taking such a leap. Instead, the dissent expresses a bevy of unsupported opinions. It offers its conclusory belief that the taking of a red wolf does not constitute an economic activity. *Post* at 507. It announces with some confidence that trade in wolf pelts will never revive. *Post* at 508-09. And it dismisses the available studies on the red wolf's ecological and commercial value without offering the slightest bit of evidence to contradict them. *Post* at 506-07. Where exactly the dissent derives its view of the inconsequential status of this species is a mystery to us. But it cannot be that the mere expression of judicial derision for the efforts of the democratic branches is enough to discard them.

[19] [20] There should be no doubt about the implications of the dissenting opinion. Our dissenting colleague would rework the relationship between the judiciary and its coordinate branches. It is apparent that the dissent regards § 17.84(c) as ill-advised. That is fair enough, but a judge's view of the wisdom of enacted policies affords no warrant for declaring them unconstitutional. *See TVA v. Hill,* 437 U.S. at 195, 98 S.Ct. 2279 ("[I]n our

constitutional system the commitment to the separation of powers is too fundamental for us to pre-empt congressional action by judicially decreeing what accords with 'common sense and the public weal.' Our Constitution vests such responsibilities in the political branches."). In recognition of the fact that the wisdom of legislation is different from its constitutionality, courts have always started with a presumption in favor of an enactment's constitutionality. *Lopez* and *Morrison* have not shifted this presumption. In fact, they have care-fully maintained it. *See Morrison,* 120 S.Ct. at 1748 ("Due respect for the decisions of a coordinate branch of Government demands that we invalidate a congressional enactment only upon a plain showing that Congress has exceeded its constitutional bounds."); *Lopez,* 514 U.S. at 568, 115 S.Ct. 1624. Our dissenting brother proceeds on the quite contrary premise that the burden now rests with those who wish to uphold legislation. We know of no other way to interpret the dissent's view that the empirical underpinnings of this regulation are inadequate.

***505** Reversing the presumption in favor of constitutionality plunges our dissenting brother into the thick of political controversy. As the arguments and briefs in this case attest, the matter in question involves a rather traditional struggle between property owners on the one hand and environmentalists on the other. Both sides in this political stand-off have their legitimate points to make. Property owners understandably seek more freedom to take wolves on their property. Those opposing them seek to impress the fact that even private property has historically been imbued with public responsibilities. Why the judicial branch should place its thumb on either side of this old political scale is simply beyond our comprehension. Both concern for property rights and concern for the environment play important roles in shaping political decisions. But neither can automatically be allowed to grind the nation's commerce power to a constitutional halt. An indiscriminate willingness to constitutionalize recurrent political controversies will weaken democratic authority and spell no end of trouble for the courts.

This danger is made more acute by the failure of the dissent to adopt any limiting principle for its approach. The dissent dismisses the regulation at issue as implicating nothing more than "a handful of animals, if even that, in one small region of one state." *Post* at 508. It declares that because there are only 41 wolves on private land, "the killing of even all 41 of the estimated red wolves" cannot have a substantial effect on interstate commerce. *Post* at 507. Far from being a limiting approach, the dissent's formulation is one of unprecedented breadth. It holds in essence that an endangered species can have no effect on interstate commerce on account of its endangered status and that scarce resources are on account of their scarcity too trivial to justify protection. The dissent further ignores the fact that the scarcest of natural resources, be they wildlife or mineral, will often be found in one limited locality. For the federal courts to constitutionally disable the federal government from acting in the face of scarcity is to deal a severe blow to national strength.

Sapping the national ability to safeguard natural resources is not a course supported by precedent. After *Lopez,* the Supreme Court upheld a broad interpretation of the Endangered Species Act, *see Sweet Home,* 515 U.S. 687, 115 S.Ct. 2407, 132 L.Ed.2d 597. And in *Morrison* the Supreme Court cited *Wickard v. Filburn* and *Heart of Atlanta Motel* for the proposition that the authority of the national government to regulate intrastate economic activity in proper circumstances had not been dismembered. 120 S.Ct. at 1749-50. Yet in the truncated legal universe of the dissent, the national interest in the development of natural resources counts for naught, and these cases and propositions have little, if any, role to play.

[21] Finally, the dissenting opinion works a rent in the fabric of Our Federalism. Striking down this regulation will turn federalism on its head. *Lopez* and *Morrison* rightly emphasized the fact that the federal involvement with local school zones and the creation of civil causes of action to prevent gender-motivated violence encroached on what are traditional state functions. By contrast, the preservation of endangered species is historically a federal function. *Lopez* and *Morrison* recognized the importance of judicial review under the Commerce Clause. But, unlike the dissent, those cases set boundaries to that review and did not transform the reviewing function from a shield protecting state activities into a sword dismembering a long recognized federal one. It is as threatening to federalism for courts to erode the historic national role over scarce resource conservation as it is for Congress to usurp traditional state prerogatives in such areas as education and domestic relations. Courts seeking to enforce the structural constraints of federalism must respect the balance on both sides.[5]

***506** Of course natural resource conservation is economic and commercial. If we were to decide that this regulation lacked a substantial effect on commerce and therefore was invalid, we would open the door to standardless judicial rejection of democratic initiatives of all sorts. Courts need not side with one party or the other on the wisdom of this endangered species regulation. We hold only as a basic maxim of judicial restraint that Congress may

constitutionally address the problem of protecting endangered species in the manner undertaken herein. The political, not the judicial, process is the appropriate arena for the resolution of this particular dispute. The judgment of the district court is accordingly

AFFIRMED.

LUTTIG, Circuit Judge, dissenting:

I wrote extensively on the Supreme Court's decision in *United States v. Lopez,* 514 U.S. 549, 115 S.Ct. 1624, 131 L.Ed.2d 626 (1995), and on the Commerce Clause in the wake of that decision, in *Brzonkala v. Virginia Polytechnic Institute,* 169 F.3d 820 (4th Cir.1999). And the Supreme Court has now provided even further guidance for the lower courts through its decision in *Brzonkala,* which is ultimately styled in that court as *United States v. Morrison,* 529 U.S. 598, 120 S.Ct. 1740, 146 L.Ed.2d 658 (2000). If one holds the views expressed by the Supreme Court majority in *Lopez* and *Morrison,* and by our court in *Brzonkala,* a belabored discussion of the implications of those decisions for the regulation at issue before us today is not necessary.

Here, the Fish and Wildlife Service has promulgated a regulation that prohibits private landowners from shooting, wounding, killing, trapping, or otherwise harming the *canis rufus,* or the red wolf, even when the wolves are on the private landowners' property and threatening their crops and livestock. However, in what the majority characterizes as an act of beneficence by the government to benefit the landowners, the government does allow a property owner-even on his own property-to kill a wolf if the wolf is about to kill the property owner himself or his family. *Ante* at 488. The question presented to us for decision is not "whether the national government can act to conserve scarce natural resources of value to our entire country," *ante* at 486, whether we should "hold as a basic maxim of judicial restraint that Congress may constitutionally address the problem of protecting endangered species," *id.* at 506, or whether our decision today will "work[ ] a rent in the fabric of Our Federalism," *id.* at 505, "turn federalism on its head," *id.,* or "open the door to standardless judicial rejection of democratic initiatives of all sorts," *id.* at 506. Rather, the simple (and frankly, considerably less incitant) question of law for us to decide is whether, assuming its validity under statute, this one particular Fish and Wildlife regulation exceeds Congress' power under the Commerce Clause.

As the majority recites, there are an estimated 41 red wolves resident on private property and 75 red wolves total, in eastern North Carolina. The majority sustains the Fish and Wildlife's regulation unhesitatingly on the ground that the taking of the 41 red wolves that might occur as property owners attempt to protect themselves and their families, their property, their crops, and their livestock from these wolves, will have a "substantial effect" on interstate commerce. This substantial effect on interstate commerce comprises, according to the majority, four ***507** separate effects on such commerce, each of which the majority views as "substantial."

First, the majority concludes, in exclusive reliance upon a Cornell University professor's unpublished study entitled "Red Wolf Recovery in Northeastern North Carolina and the Great Smoky Mountains National Park," that "[m]any tourists travel to North Carolina from throughout the country for 'howling events'-evenings of listening to wolf howls accompanied by educational programs," *id.* at 493-94, and thus that the taking of these wolves will have a substantial effect on the interstate commercial industry of tourism.

Second, the majority concludes, largely in reliance, not upon their substantive conclusions, but rather upon the fact of the generation of two articles-"The Red Wolf as a Model for Carnivore Reintroductions," which was published in the Symposium of the Zoological Society of London, and the 1994 unpublished study "Alligator River National Wildlife Refuge Red Wolf (*Canis Rufus*) Scat Analysis"-that the taking of these red wolves will have a substantial effect on the "interstate market" of "scientific research." *Ante* at 494-95.

Third, the majority concludes, largely on the strength of an article that appears in the University of Pennsylvania Journal of International Economic Law, that the taking of these wolves will have a substantial effect on the majority-anticipated resurrection of an interstate trade in fur pelts. *Ante* at 495. In reliance upon an article that appeared two years ago in the *Calgary Herald* entitled "Hunters on Snowmobiles Cut Down Wolf Count in N.W.T.," the majority observes that "[f]or example, in the Northwestern Territories of Canada where wolves are plentiful, a hunter can command about $300 per pelt." *Ante* at 503. The majority frankly acknowledges that there has not been a trade in wolf pelts since the 1800s, *ante* at 495, but, to the majority, "this temporal difference is beside the point." *Id.*

Finally, in reliance upon yet another unpublished study by Robert Esher and Theodore Simons entitled "Red Wolf

Propagation on Horn Island, Mississippi: Red Wolf Ecological Studies," and by analogy to the finding therein of "increased shore bird nesting, likely due to the reduction in raccoon predation," *ante* at 495, the majority concludes that the red wolves which the farmers and landowners have heretofore thought threatened their families, their crops, and their livestock, actually help the farmers, by killing the animals that destroy the farmers' crops, and thereby substantially affect interstate commerce. *Ante* at 495-96.

That these conclusions are not even arguably sustainable under *Lopez, Morrison,* and *Brzonkala,* much less for the reasons cobbled together by the majority, is evident from the mere recitation of the conclusions. The killing of even all 41 of the estimated red wolves that live on private property in North Carolina would not constitute an economic activity of the kind held by the Court in *Lopez* and in *Morrison* to be of central concern to the Commerce Clause, if it could be said to constitute an economic activity at all. *Morrison,* 120 S.Ct. at 1750 ("[A] fair reading of *Lopez* shows that the noneconomic, criminal nature of the conduct at issue was central to our decision in that case."). It is for this reason that the majority's attempted aggregation is impermissible: "While we need not adopt a categorical rule against aggregating the effects of any noneconomic activity in order to decide these cases, thus far in our Nation's history our cases have upheld Commerce Clause regulation of intrastate activity only where that activity is economic in nature." 120 S.Ct. at 1751 (citations omitted). But even assuming that such is an economic activity, it certainly is not an activity that has a substantial effect on interstate commerce. The number of inferences (not even to mention the amount of speculation) necessary to discern in this activity a substantial effect on interstate commerce is exponentially greater than the number necessary in *Lopez* to show a substantial effect on interstate commerce from the sale of guns ***508** near schools or in *Morrison* to show a substantial effect on interstate commerce from domestic assault. The number (and the speculation) is even greater than that necessary in *Wickard v. Filburn,* 317 U.S. 111, 63 S.Ct. 82, 87 L.Ed. 122 (1942). And, it bears reminding, the regulated activity in *Lopez* and *Wickard* at least was in some sense economic in character.

In a word, the expansive view of the Commerce power expressed by the majority today is closely akin to that separately expressed by Justice Breyer in his dissent in *Lopez* and Justice Souter in his dissent in *Morrison,* and certainly more closely akin to those dissenting Justices' views than it is to the view of the *Lopez* majority in *Lopez* and *Morrison.* Indeed, all in all, it is a view far more expansive than that expressed by *any* of the dissenting Justices in either *Lopez* or *Morrison*-a fact confirmed by the dissents in *Morrison,* ironically the case for which the majority herein unnecessarily held this case in abeyance. *See* Order of April 21, 2000 (Luttig, J., dissenting from abeyance order). It goes without saying that it is much more like that of the dissent in *Brzonkala* than that of the majority in our court. *See Brzonkala v. Virginia Polytechnic Institute,* 169 F.3d 820, 905 (Motz, J., dissenting).

Indeed, if the Supreme Court were to render tomorrow the identical opinion that the majority does today (not necessarily the decision, but the opinion, worded capaciously as it is), both *Lopez* and *Morrison* would be consigned to aberration. And, by deciding this case as it does, and on the particular reasoning that it does, the majority would have all but consigned to aberration our own decision in *Brzonkala* were it not for the Supreme Court's recent affirmance of that decision.

I would invalidate this particular agency regulation under *Lopez, Morrison,* and *Brzonkala,* and instead recognize as the aberration that action of invalidation, rather than the opinions in *Lopez, Morrison,* and *Brzonkala,* as does the majority. *Compare Morrison,* 120 S.Ct. at 1773-74 (Souter, J., dissenting) (similarly to majority, characterizing *Lopez* and *Morrison,* and by implication *Brzonkala,* as aberrational vis-a-vis the sixty years of jurisprudence predating *Lopez* and predicting that *Lopez* and *Morrison* will not be "enduring law"); *see also Morrison,* 120 S.Ct. at 1777-78 (Breyer, J., dissenting) ("And even were I to accept *Lopez* as an accurate statement of the law, which I do not...."). I would do so without any fear whatsoever that such "would place in peril the entire federal regulatory scheme for wildlife and natural resource conservation," *ante* at 504, as the majority over-rhetorically predicts would result from the invalidation of this lone regulation. No more so than in *Brzonkala* will "[m]aintaining the integrity of the enumerated powers" by invalidating this single regulation "mean that statutes will topple like falling dominos." *Brzonkala,* 169 F.3d at 897 (Wilkinson, J., concurring).

While it could be lost in a reading of the majority opinion, we do not address here Congress' power over either the channels or instrumentalities of interstate commerce. We do not address activity that is interstate in character. We do not address in this case a statute or a regulation with an express interstate commerce jurisdictional requirement, which would all but ensure constitutional validity. We do not have before us an activity that has obvious economic character and impact, such as is typically the case with non-wildlife natural resources, and even with other wildlife resources. We are not even presented with an

activity as to which a plausible case of future economic character and impact can be made.

To the contrary, we are confronted here with an administrative agency regulation of an activity that implicates but a handful of animals, if even that, in one small region of one state. An activity that not only has no current economic character, but one that concededly has had no economic character for well over a century now. An activity that has no foreseeable economic ***509** character at all, except upon the baldest (though admittedly most humorous) of speculation that the red wolf pelt trade will once again emerge as a centerpiece of our Nation's economy. And, importantly, an activity that Congress could plainly regulate under its spending power and under its power over federal lands, regardless.

Judge Wilkinson, for his part, has written that he regards *Lopez*, *Brzonkala*, and presumably now *Morrison*, as examples in a "spate of decisions" of "contemporary judicial activism," *Brzonkala,* 169 F.3d 820, 892-93 (Wilkinson, J., concurring), as he similarly regards the Supreme Court's decisions in *Printz v. United States,* 521 U.S. 898, 117 S.Ct. 2365, 138 L.Ed.2d 914 (1997); *City of Boerne v. Flores,* 521 U.S. 507, 117 S.Ct. 2157, 138 L.Ed.2d 624 (1997); *Seminole Tribe v. Florida,* 517 U.S. 44, 116 S.Ct. 1114, 134 L.Ed.2d 252 (1996); and *New York v. United States,* 505 U.S. 144, 112 S.Ct. 2408, 120 L.Ed.2d 120 (1992). *See id.* The dissenting Justices in both *Lopez* and *Morrison* similarly regard these decisions. *See, e.g., Morrison,* 120 S.Ct. at 1759 (Souter, J., dissenting); *see also Morrison,* 120 S.Ct. at 1773-74 (Breyer, J., dissenting). But I do not regard these decisions as such, and I certainly do not understand the majority of the Supreme Court to so regard these decisions.

Nor, in the wake of *Lopez* and *Morrison*, can I accept my colleagues' view of the appropriate role of the judiciary in Commerce Clause disputes. As Judge Wilkinson's view of *Lopez* mirrors that of the dissenters in *Lopez* and *Morrison*, so also does my colleagues' view of the judiciary's role in Commerce Clause conflicts mirror that of the *Lopez* and *Morrison* dissenters. The majority herein, like the dissents in both *Lopez* and *Morrison*, takes the view that the political processes are the safeguard against federal encroachment upon the states. Thus, the majority concludes its opinion: "The political, not the judicial, process is the appropriate arena for the resolution of this particular dispute." *See ante* at 506. *Accord Morrison,* 120 S.Ct. at 1768-69 (Souter, J., dissenting) ("The defect, in essence, is the majority's rejection of the Founders' considered judgment that politics, not judicial review, should mediate between state and national interests ...."); *id.* at 1769 ("As with 'conflicts of economic interest,' so with supposed conflicts of sovereign political interests implicated by the Commerce Clause: the Constitution remits them to politics."); *id.* (Breyer, J., dissenting) (citing Souter, J., dissenting, in *Morrison;* Stevens, J., dissenting, in *Kimel v. Florida Bd. of Regents,* 528 U.S. 62, 120 S.Ct. 631, 145 L.Ed.2d 522 (2000); and Blackmun, J., for the court, in *Garcia v. San Antonio Metropolitan Transit Authority,* 469 U.S. 528, 105 S.Ct. 1005, 83 L.Ed.2d 1016 (1985)).

The majority of the Supreme Court in *Lopez* and *Morrison* has left no doubt, however, that the interpretation of this clause of the Constitution, no less so than any other, must *ultimately* rest not with the political branches, but with the judiciary. *See Lopez,* 514 U.S. 549, 557 n. 2, 115 S.Ct. 1624, 131 L.Ed.2d 626 ("[W]hether particular operations affect interstate commerce sufficiently to come under the constitutional power of Congress to regulate them is ultimately a judicial rather than a legislative question, and can be settled finally only by this Court.") (quoting *Heart of Atlanta Motel v. United States,* 379 U.S. 241, 273, 85 S.Ct. 348, 13 L.Ed.2d 258 (1964) (Black, J., concurring)); *Morrison,* 120 S.Ct. at 1753 n. 7 ("Departing from their parliamentary past, the Framers adopted a written Constitution that further divided authority at the federal level so that the Constitution's provisions would not be defined solely by the political branches nor the scope of legislative power limited only by public opinion and the legislature's self-restraint. *See, e.g., Marbury v. Madison,* 1 Cranch 137, 176, 2 L.Ed. 60 (1803) (Marshall, C.J.).").

Accordingly, I would faithfully apply in this case the Supreme Court's landmark decisions in *Lopez* and *Morrison,* as I ***510** would in any other case. The affirmative reach and the negative limits of the Commerce Clause do not wax and wane depending upon the subject matter of the particular legislation under challenge.

All Citations

214 F.3d 483, 50 ERC 1863

Footnotes

1 The Service notes that the red wolf population lies between 53 and 101 wolves, and estimates that the actual population is between 70 and 80 animals. The district court also found that approximately 75 red wolves were living in the wild in eastern North Carolina. *See Gibbs v. Babbitt,* 31 F.Supp.2d 531, 534 (E.D.N.C.1998).

2 While the regulation might also reflect a moral judgment concerning the importance of rehabilitating endangered species, this does not undermine the economic basis for the regulation. *See Heart of Atlanta Motel, Inc. v. United States,* 379 U.S. 241, 257, 85 S.Ct. 348, 13 L.Ed.2d 258 (1964) ("Congress was not restricted by the fact that the particular obstruction to interstate commerce with which it was dealing was also deemed a moral and social wrong.").

3 The Supreme Court has admonished us that "[t]he task of a court that is asked to determine whether a particular exercise of congressional power is valid under the Commerce Clause is relatively narrow. The court must defer to a congressional finding that a regulated activity affects interstate commerce, if there is any rational basis for such a finding." *Hodel v. Virginia Surface Mining & Reclamation Assoc.,* 452 U.S. 264, 276, 101 S.Ct. 2352, 69 L.Ed.2d 1 (1981).

While there are no formal congressional findings that the ESA affects interstate commerce, such findings are neither necessary nor sufficient to sustain a statute or regulation. In *Lopez,* the Court said that "Congress normally is not required to make formal findings as to the substantial burdens that an activity has on interstate commerce." 514 U.S. at 562, 115 S.Ct. 1624; *see also Perez v. United States,* 402 U.S. 146, 156, 91 S.Ct. 1357, 28 L.Ed.2d 686 (1971) (particularized findings are not necessary for Congress to legislate). Further, in *Morrison,* the Court emphasized in the face of voluminous congressional findings that "the existence of congressional findings is not sufficient, by itself, to sustain the constitutionality of Commerce Clause legislation." 120 S.Ct. at 1752.

In evaluating whether there is a rational basis for the promulgation of a statute or regulation under the commerce power, we often consider congressional committee findings. *See Lopez,* 514 U.S. at 562, 115 S.Ct. 1624. Here, Congress has provided numerous sources of informal findings. Committee reports and legislative debates have emphasized the importance of endangered species to interstate commerce. We independently evaluate the constitutionality of this regulation, but we also take account of congressional judgment and the judgment of the agency designated to implement the statute.

4 Intervenor-appellees Defenders of Wildlife argue that this regulation can also be upheld under the treaty power. *See* U.S. Const. art. VI., cl. 2; U.S. Const. art. II, § 2, cl. 2. Because we hold that § 17.84(c) is valid under the Commerce Clause, we need not address this alternative argument.

5 Emphasizing the political nature of this particular dispute does not consign Commerce Clause adjudications to the political processes, but rather takes account of the fact that judicial review is limited by the due respect that we must have for the decisions of a coordinate branch. *See Morrison,* 120 S.Ct. at 1748-49. It is therefore both amusing and incorrect for the dissent to suggest that upholding this endangered species regulation would somehow render *Lopez* or *Morrison* an "aberration," *post* at 508. The dissent ignores the significant differences between those cases and the present one-differences that we have chronicled in detail and with which the dissent has made no effort to deal.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

September 10, 2015

Memorandum

To: Red Wolf Recovery Lead, Alligator River National Wildlife Refuge, North Carolina

From: Field Supervisor, Ecological Services Office, Raleigh, NC

Subject: Intra-Service Section 7 Biological Opinion for the Red Wolf *(Canis rufus)* Captive Transfer Program and associated wild release

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion based on our review of the currently suspended captive transfer program of the federally endangered red wolf (*Canis rufus*) from the captive breeding facilities into the Northeastern North Carolina recovery area.

This document has been prepared to analyze the effects of any potential take associated with this programs action if it is reactivated in the future. The analysis of the effects of this action includes an assessment of the effects of past released into the wild experimental population authorized by this program in order to provide a full context for evaluating the effects of potential future releases from the captive breeding facilities.

This Biological Opinion is provided in accordance with section 7(a)(2) of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.). Your verbal request for formal consultation and accompanying biological information (April 2015) were received on April 22, 2015.

This Biological Opinion addresses only the affects to captive bred red wolves that are part of the Captive Transfer program and the non-essential population in the Northeastern North Carolina, where the captive pups potentially would be released if the program is reactivated in the future. If you have any questions concerning this Biological Opinion, please contact Pete Benjamin at (919) 856-4520 (Ext. 11)

The following Biological Opinion (BO) is based on information provided in previous Service BO's for the red wolf or this type of action, in addition to scientific reports, experts' opinions and the red wolf program staff data. Data gathered from meetings, emails, phone conversations and other sources of published and unpublished information are also incorporated in this document. A complete administrative record of this consultation is on file at this office.

Consultation History

March 13, 1986 -- request for an Intra-Service Section 7 consultation on the Proposed Red Wolf Reintroduction at Alligator River National Wildlife Refuge (NWR) in Dare and Tyrrell counties NC.

April 23, 1986 -- Intra-Service Biological Opinion Issued for the Proposed Red Wolf Reintroduction at Alligator River NWR (FWS Log No. 4-0-86-022).

July 24, 1986 -- Proposed Determination of Experimental Population Status for an Introduced Population of Red Wolves in North Carolina (51 FR142).

November 19, 1986 Determination of Experimental Population Status for an Introduced Population of Red Wolves in North Carolina (51 FR223).

September 1987- August 1991 -- Release of 37 captive- and/or island-born red wolves were released in North Carolina.

1990 – Recovery/Species Survival Plan.

November 4, 1991 – Proposed Determination of Experimental Population Status for an Introduced Population of Red Wolves in North Carolina and Tennessee (56 FR213).

June 1993 - Intra-Service Section 7 Consultation for Proposed Red Wolf Release Plan. Pocosin Lakes National Wildlife Refuge.

November 24, 1993 - Proposed Revision of the Special Rule for Nonessential Experimental Populations of Red Wolves in North Carolina and Tennessee (58 FR225).

April 13, 1995 - Revision of the Special Rule for Nonessential Experimental Populations of Red Wolves in North Carolina and Tennessee (60 FR71).

October 8, 1998 – Attempts to restore a wild population of red wolves in the Great Smoky Mountains National Park in North Carolina and Tennessee were terminated (63 FR195).

September 28, 2007 – 5 Year Review.

April 22, 2015-- Meeting with Red Wolf program staff at Raleigh Ecological Services Field Office and Intra-Service request for Section 7 formal consultation on the action.

August 31, 2015 final draft BO reviewed by Red Wolf Recovery Lead.

September 10, 2015 BO final.

Biological Opinion

I. Description of Proposed Action

The Service propose to continue the Red Wolf Species Survival Plan (SSP) captive breeding program and to release approximately 2 captive bred red wolves into the non-essential, experimental population (NEP) area on a yearly basis within Beaufort, Dare, Hyde, Tyrell and Washington Counties in North Carolina if the program is reactivated in the future. Captive transfer protocol will be used to reduce stress and harm to the captive population during the capture and removal of the captive animal(s) and its transportation and introduction into the NEP. Careful introduction methods and protocols (Phillips et al. 2003, Waddell and Rabon 2012) will be applied in the introduction of the captive-born animals into the NEP to reduce stress to both the captive-born animal(s) and any existing NEP pack affected.

A. Action Area

The action area for this BO includes all of the SSP captive breeding facilities in which a captive-born red wolves could potentially be removed from and then transferred and introduced into the NEP area in northeastern North Carolina. These facilities include 44 different institutions located throughout the U.S., the majority of which occur within the historical distribution of the red wolf (Table 1).

The action area also includes the NEP in northeastern North Carolina where these captive bred wolves from the various SSP facilities will be introduced and released into the wild as deemed appropriate.

In addition to the captive facilities in the red wolf SSP network,, red wolves also historically existed on multiple island propagations. The only island propagation site currently in operation is St. Vincent NWR in northern Florida. This area consists of approximately 12,000 acres and currently has one resident breeding pair of red wolves. Historically, island propagation sites were utilized to evaluate different release techniques and to allow a mechanism for importing individuals into the NEP via release individuals that could augment the wild red wolf gene pool with under-represented genes from the captive red wolf population (USFWS 1990, Henry et al. 1995, USFWS 2007).

This action area represents the area of potential direct and indirect effects to red wolves.

B. Conservation Measures

Conservation measures represent actions, pledged in the project description, that the action agency will implement to minimize the effects of the proposed action and further the recovery of the species under review. Such measures should be closely related to the action and should be achievable within the authority of the action agency. Since conservation measures are part of the proposed action, their implementation is required under the terms of the consultation. The U.S. Fish and Wildlife Service have proposed the following conservation measures:

From September 1987 through April 2014, 134 red wolves were released into the five county recovery area in northeastern North Carolina including 42 adults (≥2 years of age), 22 juveniles (between 12-24 months of age, and 70 pups (< 1 year of age). The majority were captive-born (n = 90). Forty animals were born on island propagation sites, and four animals were transferred from the former NEP in Great Smokey Mountains National Park when the reintroduction efforts were terminated. Animals were released as mated breeding pairs, sibling groups, family groups, or foster pups. Length of acclimation, release area, location of resident wolves, and type of social group released all affected the probability of a wolf successfully establishing itself in the wild (Phillips 1994). Longer acclimation periods (months)

have proven more successfully at addressing concerns with the survival rates and potential tolerance to human activity of captive-born animals (Henry and Lucash 2000). Husbandry of animals identified for potential release can also minimize negative impacts to the released animals once free-ranging. Care should be taken to modify nutritional needs to ensure appropriate feeding patterns and behaviors are stimulated (AZA Canid TAG 2012).

During the past ten years, pup fostering has developed as a significant and useful population management tool in red wolf recovery (Kitchen and Knowlton 2006. Waddell and Rabon 2012). Fostering involves placing captive-born pups less than two weeks old into the den of wild red wolf parents. The parents adopt and raise the fostered pups, teaching them valuable survival skills. Since 2002, 29 red wolf pups were fostered into the NEP from captive facilities or island propagation sites. Due to logistical constraints and initial conditions, the number of potential transfers has varied since 2002. On average, 2.2 pups were fostered/year (range 0-7). In cases of litter replacement (where hybrid litters were identified or where wolf litters died), more pups may be transferred in a given year.

Initial factors considered prior to fostering attempts from captive or island sites to the NEP include location of source (where animals were born), location of recipient (surrogate) litter(s), accessibility of wild dens site(s), landowner access (if on private lands), litter size(s), identification of a hybrid litter (to be replaced by fostered animals), and potential demographic and genetic benefits to the NEP. When possible, attempts are made to closely match the ages of source and recipient pups. In all cases, the eyes of source and recipient pups involved in the fostering events were still closed or had just opened (pups 10-14 days old) at the time of fostering.

Depending on source location, wolves are either driven to the NEP or flown commercially. When air travel is the transportation, personnel from the participating SSP institution accompanies the animals, carrying them on in a transport kennel (i.e., pups are not flown in cargo). Transportation protocols are based on recommendations by the Canid Taxon Advisory Group in association with AZA Animal Welfare Committee (AZA Canid TAG 2012).

Management of the free-ranging red wolf NEP population includes locating and handling neonate litters at the den site (Beck et al. 2009). Free ranging reproductive females typically show localized movements prior to whelping (late March – May) and are regularly monitored by radio (VHF) telemetry collars via ground or aerial tracking. When a wild litter is located and identified, the decision to foster pups from the captive population initially addresses the potential benefit (e.g., demographic or hybrid litter replacement) to the wild NEP population. Den site locations that historically supported successful pup rearing, that have breeding pairs with stable territories, and have an adult female with proven rearing success are also factors considered. Litter size, sex ratio, and pup ages are assessed and the availability of age-appropriate captive litters, their litter size, and sex ratio determined. Source pups from selected litters are driven to the recovery area in a small transport kennel and walked to the den location with program personnel. In the field, all pups are handled with latex gloves to minimize exposure to pathogens. When animals are being added to an existing litter, the wild-born pup(s) are located and removed from the den site, minimizing disturbance at the site, in order to transfer scent to foster animals. Scent transfer occurs through stimulation of wild-born pups to urinate and then scent is rubbed on foster animals before returning both wild-born and fostered pups together to den site.

After placing pups in a den, the recipient dam is monitored daily by radio telemetry for 3-5 days to confirm her return to the den site. While it is not uncommon for wild red wolves to move their pups at this age, to minimize disturbance movements of a dam are observed remotely via telemetry methods. There are no attempts to verify the location of the pups until the fall trapping season. At this time, juveniles are large enough to be safely trapped and equipped with radio collars.

Initial considered factors, transfer methods, and processing techniques are generally similar in fostering events occurring between captive locations. Scent transfer does not occur as the foster parents remain in the enclosure during the introduction of the new pups. Activity levels of all pups are observed daily for 5-7 days following placement in a recipient litter. If any pup appeared to be developmentally compromised, weights are obtained by facility staff to ensure neonate growth was consistent among litter mates.

For all other types of releases, red wolves were either transported to remote sites and released directly from shipping containers or released directly from acclimation pens (Phillips et al. 2003). Refinement of these release techniques and the development of island propagation sites led to the more recent practice of using primarily acclimation pens and discontinuing direct releases (Phillips et al. 1995, 2003). During acclimation periods, human contact was minimized and supplemental food was provided. A standard series of canine vaccines, heartworm preventative, and parasiticide were administered to all animals (Phillips et al. 1995). Prior to release, adults were fitted with radio collars and juveniles were often implanted with abdominal transmitters.

II. Status of the Species

A. Species/critical habitat description

The red wolf is a canid intermediate in size between a coyote *(Canis latrans)* and a gray wolf *(Canis lupus)*. Weighing 53 to 84 pounds, red wolves are about four feet long from nose to tail and stand roughly 26 inches at the shoulder. They have tall pointed ears, long legs, and large feet. Red wolves are typically reddish-brown and buff colored with black along their backs (USFWS 2014).

Red wolves are believed to have once ranged across the eastern United States from the Atlantic coast west to central Texas, and from the Gulf of Mexico northward to New York (Nowak 2002, Chambers et al. 2012). However, by the 1970s, predator control programs and loss/alteration of habitat had reduced the red wolf population to a small remnant population along the Gulf coast of eastern Texas and western Louisiana. To protect the species from extinction, the Service located and captured as many red wolves as possible to establish a captive breeding program. Although more than 400 canids were captured, ultimately only 14 individuals met the criteria to define the species and were deemed suitable founding members to establish a breeding population. Those 14 red wolves are the ancestors of all red wolves existing today (USFWS 1990, Kelly et al. 1999). After successfully producing sufficient numbers of red wolves in captivity, the Service began releasing red wolves into the Alligator River NWR in 1987. From 1987 to 1994, more than 60 red wolves were released (Phillips et al. 2003). Since then, the NEP has expanded throughout the five counties of the Recovery Area.

On November 4, 1991, the Service published a rule (56 FR 213) to introduce red wolves as a second NEP into the Great Smoky Mountains National Park, Haywood and Swayne Counties, North Carolina and Blount, Cocke and Sevier Counties in Tennessee (Lucash and Crawford 1993). These efforts were discontinued in 1998 (63 FR195, USFWS 2007) due to lack of resources on the area, poor pup survival, and the dispersal patterns of red wolves released on site. The surviving animals from the Park were placed in captivity or transferred to the North Carolina NEP.

The red wolf was originally listed as endangered on March 11, 1967 under the provisions of the Endangered Species Preservation Act of 1966 (USFWS 1967). Currently, the red wolf is listed as endangered under the provisions of the Endangered Species Act of 1973 (ESA). The Service designated a population of the red wolves as "Experimental Population, Non-Essential" in the Albemarle Peninsula of northeastern North Carolina on November 19, 1986.

Under Section 10(j) of the ESA, the Service is authorized to introduce an "experimental population" of a listed species outside the species' current range, if the Service determines that such a release would further the conservation of the species. Congress added Section 10(j) to the ESA in 1982 in response to testimony by state fish and wildlife agencies.

Section 10(j) defines an NEP as a population that the Service has determined is not essential to the continued existence of the species. For the purposes of Section 7 of the ESA, which includes federal agency actions and consultations, a NEP is treated as a species proposed for listing, however, when it occurs on National Wildlife Refuge System or National Park System lands it is treated as a threatened species. Under Section 10(j), an NEP shall be treated as a threatened species for the purposes of Sections 4(d) and 9 of the ESA, which regulate the take of listed species. Therefore, take of the species may only occur as provided in the special (4(d)) rule set forth at 50 C.F.R. § 17.84(c).

The recovery objectives for the red wolf include a captive population of at least 330 animals in at a least 30 facilities and a target wild population of at least 220 animals maintained at three restoration sites within the historic range of the species. Another objective is to preserve 80 to 85 percent of the average heterozygosity of the original wild population (equivalent to 90 percent of the existing heterozygosity in the captive population) for the next 150 years (USFWS 1990). Currently, there are 190 red wolves in captivity located at 44 facilities which participate in the Red Wolf Species Survival Plan (Table 1). Within the captive population, 12 founders are represented with ~89% gene diversity (Waddell and Long 2015). The one NEP population is estimated to have 50-75 free-ranging red wolves in the current recovery area. Based on recent population models and evaluations, the gene diversity in the NEP is approximately 84%, and 12 founders are currently represented (Simonis et al. 2015).

No critical habitat has been designated for red wolves.

B. Life History

The primary social structure of red wolves is defined as an extended family unit or pack. A typical pack consists of five to eight members, which includes a breeding adult pair and offspring from different years. Wolf packs have specific territories that they actively defend against other canids, including other wolves. Within the NEP, USFWS biologists have observed territory sizes range from 8,000 – 40,000 acres, with a likely average of 10-15,000 acres. The variation on size depends on factors including pack size, habitat quality, and prey and resource availability. The pack is a very close-knit social group, and older offspring will often assist the breeding pair in the rearing of pups. Almost all offspring between one and two years of age will leave the pack or disperse to form their own pack (USFWS 2014).

Red wolves tend to form pair-bonds for life and mate once a year in February or March. Pups are born 60-63 days later in April or May and are well hidden in dens located along stream banks, sand knolls, or in shallow depressions in the ground. Dens also have been found in holes dug in the ground near downed logs or forest debris piles (USFWS 2014). Den areas in captive facilities also include underground holes, culverts, or den boxes as available.

Red wolves generally live 7-8 years in the wild and up to 15 years in captivity (Waddell and Long 2015). As of April 1, 2015 there were 83 males and 107 females within the captive population. In 2007, the captive population experienced a large number of births, resulting in a current unstable age structure of a high proportion of 7-8 year-old animals (predominantly females; Waddell and Long 2015). Within the captive population, pup survival rates have averaged 38% for males and 36% for females historically (1980 – 2014; Waddell and Long 2015). However, in the past ten years average pup survival has increased to 66% for males and 77% for females, possibly due to bias of the current female-skewed age structure in the Species Survival Plan facilities (Waddell and Long 2015). Demographic analyses indicate

that the most fecund reproductive age classes are between 3- and 9-years-old, with both genders capable of breeding as early as one year of age. The upper limits of reproduction in the captive population have been observed to been 11 and 15 years of age for males and females, respectively (Waddell and Long 2015). Annual estimates of survival for free-ranging animals in the NEP indicate overall survival is approximately 78% (USFWS 2007) with the adult age class (>2 years of age) approximately 80%. A recent analysis using population models and mark-recapture data estimate pup survival (>1 year of age) to be around 60% (Hinton et al. in review).

In the wild, the diet of red wolves varies depending on available prey. Scat surveys have found that red wolves consume white-tailed deer, raccoons, rabbits, rodents (nutria and smaller rodents), domestic and feral hogs, other mammals, and insects (Dellinger et al. 2011, McVey et al. 2013, Hinton 2014). The red wolf is an opportunistic feeder and can travel up to 20 miles a day or more to find food, which can be consumed at a rate of two to five pounds daily (USFWS 2014). In captivity, red wolf diets may vary among different institutions, but can include commercial dog food, processed meat, and natural prey items or roadkill as available. Nutritional protocols in the Red Wolf Species survival Plan facilities are based on recommendations by the Canid Taxon Advisory Group in association with AZA Animal Welfare Committee (AZA Canid TAG 2012).

Natural predation on red wolves is minimal in the NEP (USFWS 2007). Pups can be vulnerable to predation by black bears, coyotes, bobcats, alligators, or birds of prey (USFWS 2007). Red wolf and coyote diets can overlap in prey items (McVey et al. 2013, Hinton 2014). Canid diseases including canine distemper, parvovirus, borrelliosis, mange, and heartworm have threatened both wild and captive red wolf populations. Risk of disease is also partly offset by intensive vaccination programs for both re-introduced and captive red wolves (Acton et al. 2000, Brzeski et al. 2015).

C. Population Dynamics

Population Size:

As of April 1, 2015 there are 83 males and 107 females within the captive population located throughout U.S. facilities at 44 different institutions (Table 1, Waddell and Long 2015).

As of April 1, 2015, the known wild population of red wolves (those that are regularly monitored) numbered 50 with a total estimated population of 50-75 red wolves (includes likely present wolves but which are not monitored or confirmed). The population included 7 wolf packs (including six breeding pairs), 11 mixed packs (11 wolves and 11 sterile coyotes) and 10 additional wolves not associated with a pack. During the 2015 whelping season, two red wolf litters comprising 7 pups were documented by the Red Wolf Recovery Program. Additional pups or litters could be present, but are not confirmed. Pups born during the 2015 whelping season are not included in the reported population numbers. From 2011 to 2013, the number of known red wolves varied from 65 to 66 animals per year and the total estimated number of wild red wolves varied from 90 to 120 animals (USFWS 2013).

The recovery objectives for the red wolf include a captive population of at least 330 animals in at least 30 facilities and a target wild population of at least 220 animals maintained at three restoration sites within the historic range of the species.

Population Variability:

The captive population grew to nearly 200 wolves in 1994, but then decreased almost 30% due to combined low birth rates (partially due to space limitation) and export of animals to the NEP (Simonis et al. 2015). In 2004, the SSP population was 142 wolves. However, increased breeding efforts in the mid-

2000's, and in recent years, have allowed the population to rebound (Simonis et al. 2015). Current space limitations within the current participating SSP facilities continue to limit breeding potential.

Historically, annual calendar counts of red wolf adults and pups have been used to evaluate population trends in the NEP (USFWS 2007). Recently, annual red wolf population sizes were estimated by determining the sum of the total number of known radio-collared wolves together with the number of uncollared individuals remaining alive each year from October 1987–September 2013. These estimates were compiled using age-specific survival estimates using the Burnham joint Live-Dead model (Burnham 1993) in Program MARK (White and Burnham 1999; G. White, personal communication). Red wolf population estimates for the NEP indicate increasing trends over time, reaching the highest detected level in 2005–06, and then decreasing from 2007 through 2015. The wild NEP was supplemented with releases of captive-born animals 1987-1995, island-born animals 1989-2009, and through pup fostering (2000-2014) which contributed in growing the wild population. A recent analysis of mortality trends in the NEP suggested that while overall mortality trends have remained consistent, the causes of death have changed over time, with anthropogenic causes increasing over time (Hinton et al., in review). Monthly survival rates were lowest from September through January. Maximum survival occurred at five years of age, and 68% of all red wolves died before four years of age. Survival rates were lowest for red wolves < 2 years old (Hinton et al., in review).

Population Stability:

The action should not negatively affect the population stability of the red wolf in either the captive SSP facilities or the NEP. The SSP captive populations are controlled and remain stable through management actions. The action should benefit and increase the population genetics and stability of the NEP by the transfer and relocation of wolves into the NEP.

D. Status and Distribution

Reason for listing:

While described earlier (Bartram 1791), the red wolf was assigned its scientific name, *Canis rufus*, in 1851 (Audubon and Bachman 1851). Increasing development, habitat loss, aggressive predator control programs, and eventually hybridization with coyotes exterminated red wolves from most of its range. By the 1960s, federal and state agencies determined the remaining populations of red wolves existed only in the southeastern US. Researchers concluded that in some areas of the historic range including eastern Texas, Arkansas, and Oklahoma, that red wolves had generally been replaced by red wolf/coyote hybrids (McCarley 1962). With the passage of the ESA, a red wolf recovery program was established in partnership with Point Defiance Zoo and Aquarium (Tacoma, Washington), to coordinate captive breeding efforts and determine "pure" red wolves as part of a planned extirpation of red wolves in the wild. Between 1973 and 1980, only 14 canids captured within the remaining red wolf range were determined to be pure red wolves and successfully bred in captivity. By 1980, the red wolf was extirpated in the wild. In 1984, the captive breeding program was accepted by the Association of Zoos and Aquariums for development of a Species Survival Plan (SSP), and plans for re-introduction were initiated. To assess various restoration approaches (e.g., acclimation, release, and recapture techniques), captive-born red wolves were released on an island propagation site. After public opposition at the initial re-introduction at Land Between the Lakes in west Kentucky and Tennessee, Alligator River National Wildlife Refuge (North Carolina) was chosen as the red wolf re-introduction area. Extensive analyses determined feasibility due to the absence of coyotes, the lack of livestock operations, and availability of prey species. To garner public support, traditional recreational activities, such as hunting and fishing, were allowed to continue within the re-introduction area, and the re-introduced population was designated "non-essential experimental" under Section 10(j) of the ESA.

Initial captive breeding results were slow, but the first litter of red wolves was born in captivity in 1977. The red wolf captive breeding program has grown and developed since 1973, ensuring and maintaining the genetic diversity of the species. More than 40 zoos and nature centers that breed red wolves have committed substantial resources, without compensation, to the captive breeding effort. Re-introduction of captive-born red wolves into the wild began in 1987 and continued until 1995. However, red wolves were born in the wild every year since the first wild-born litter in 1988. Individuals were released from island propagation sites into the wild beginning in 1989 and efforts continued through 2009. The possibility exists to continue these efforts if the breeding pair on St. Vincent National Wildlife Refuge were to produce pups. Additionally, there were a few animals (n = 4) relocated from the reintroduction site in Great Smokey Mountains National Park to the northeastern North Carolina reintroduction area between 1995-2001. Pup fostering efforts began in 2002 and continued to place captive- or island-born pups into wild packs through 2014.

Rangewide trend:

Once on the brink of extinction in the 1970s, the 14 individuals selected for captive propagation have now expanded to approximately 190 red wolves in captivity, and the wild population has grown to 50 known, and an estimated 50-75 total individuals within the 1.7 million acre Recovery Area in northeastern North Carolina. Prior to its reintroduction into the ARNWR in 1987, the red wolf as considered extirpated in the wild (USFWS 1990).

Prior to European colonization, red wolves were common in the Eastern United States and they inhabited an area from the Atlantic coast west to central Texas, with the Ohio River Valley, Northern Pennsylvania, and Southern New York being its northernmost range and their distribution extending south to the Gulf of Mexico. Range maps have been refined in the past 45 years based on fossil evidence (Nowak 1979, 2002. 2003; Chambers et al. 2012, Hinton et al. 2013), but there is some debate on the upper boundary of the range (USFWS 2007). The current range of the NEP is limited to a five-county area encompassing approximately 1.7 million acres in northeastern North Carolina.

Although the Red Wolf Recovery Program has made great progress towards its recovery goals since reintroduction of the species into the wild beginning at Alligator River NWR in 1987, issues of hybridization with coyotes, inbreeding, and human-caused mortality continue to hamper red wolf recovery (Hinton et al. 2013). Without constant management of coyotes in the Recovery Area, the red wolf population would likely be genetically assimilated into the coyote population (Kelly et al. 1999). During the initial site selection process for red wolf re-introduction, the Recovery Area was considered uninhabited by coyotes. However, coyotes have expanded their historical range eastward and were first observed in the Recovery Area in the early 1990s. Since that time the Red Wolf Recovery Program has developed and implemented red wolf adaptive management plans to manage coyotes in order to reduce interbreeding between red wolves and coyotes (USFWS 2007, Bartel and Rabon 2013, Rabon et al. 2013). Although coyotes have become more abundant over time. since 2003 hybrids represent only 15% of the individuals captured by USFWS biologists (Gese et al. 2015). Non-invasive genetic surveys based on fecal material reveal that red wolves are clearly identifiable based on genetic markers and hybrids compose only a minor (<5%) component of the canid population (Adams et al. 2007, Bohling 2011, Bohling and Waits 2011, 2015). The overall red wolf population is composed of less than 4% coyote ancestry (Gese et al. 2015).

The small number of red wolves makes the wild population susceptible to genetic drift and inbreeding depression (Rabon and Waddell 2010). Knowledge of the full pedigree of the red wolf population and active management implementing the breeding and transfer plan in the SSP program has allowed USFWS and partners to create the best breeding pairs that promote gene diversity and minimize inbreeding.

Currently, in the captive population, 12 founders are represented with ~89% gene diversity (Waddell and Long 2015).

Within the NEP, 12 founders are represented in the wild population is 12 with 84% gene diversity (Simonis et al. 2015, Waddell and Long 2015). Recovery goals set an 80% threshold for 150 years (USFWS 1990). To minimize inbreeding and maintain genetic diversity in the wild population, captive-born and island-born individuals are periodically released into the Recovery Area (Simonis et al. 2015). Using population viability analysis modeling techniques, USFWS staff and partners are currently evaluating how management efforts in both captive and wild populations can impact these target values (Simonis et al. 2015). For example, by increasing the size of the captive population, it is predicted to be able to hit that target of desired gene diversity, which can translate into the NEP population (more gene diversity retained in captivity means more can be released into the wild population).

Given the small, isolated population of red wolves, managing inbreeding depression is a conservation priority (Hinton et al. 2013). Recessive mutations can cause inbreeding depression if they occur at genes affecting fitness. In the captive red wolf SSP population. increased levels of inbreeding are correlated with decreased litter size, but lethal equivalents are near zero suggesting minimal inbreeding depression has occurred relative to other inbred canids (Brzeski et al. 2014). This is a result of careful creation of breeding pairs, which has been successful used to reduce inbreeding and maximize genetic diversity (Waddell and Long 2015).

Current Status:

Captive red wolves

Within the current participating facilities in the SSP captive breeding program, there are 225 potential spaces. In order to increase breeding rates and allow the captive population to maintain its current size, fill available spaces. and grow to the recovery objective size, additional spaces and/or facilities are necessary. PVA models examined the effects of increasing capacity within the SSP network (Simonis et al. 2015). Increasing the population size to ~330 animals would result in higher breeding rates but also meet recovery objectives of retaining >80% gene diversity for the next 100 years (Simonis et al. 2015). Additional increases in either space availability or breeding rate will result in higher gene diversity retention over time.

While earlier reports showed a high prevalence of parasitism in captive neonates, a recent survey of diseases in the captive population showed dramatic decreases of internal parasitism, most likely due to regular deworming procedures (Acton et al. 2000, Seeley et al., in press). Increased observations of gastrointestinal diseases and inflammatory bowel disease in the captive population have resulted in additional research to determine underlying causes and contributing factors.

Wild NEP wolves

From September 1987– September 2013, USFWS staff reported 372 red wolf deaths, for which causes of death were identified for 300 (80.6%). Of the mortalities with known causes of death, human-related cases accounted for 73% of red wolf mortality whereas natural causes comprised 27% (Hinton et al., in review). Of 219 human-caused deaths, 51% involved some type of suspected foul play (n = 112). These incidents included gunshot ($n = 88$), poison ($n = 11$), and other suspected illegal take ($n = 13$). Total anthropogenic mortality increased over time, likely driven by an increasing trend of red wolf mortalities attributed to gunshot over time. Vehicle collisions, private trapping incidents, and management-related activities accounted for 34%, 8%, and 7% of the red wolf mortalities attributed to anthropogenic causes, respectively. Using data from 1990–2005, Sparkman et al. (2011) assessed the potential effects of anthropogenic mortality on the NEP and noted that anthropogenic mortality had an additive effect on the reintroduced population at low densities. However, since 2005, the average number of red wolves killed

by gunshot has increased approximately 275% when compared to years prior to 2005 (Bartel and Rabon 2013). As a result, human activity – either directly (i.e., gunshot) or indirectly (i.e., vehicle strike) – has become the leading cause of mortality for red wolves in the NEP during the past decade.

Natural causes comprised 27% of total mortalities with causes of deaths identified (n = 81). Health-related cases (~70% of mortalities attributed to natural causes) included deaths attributed to acute illness, starvation, old age disease, and deaths of pups following the death of attending adults during whelping. Risk of disease is also partly offset by intensive vaccination programs within the NEP. However, veterinary research scientists caution against the assumption that vaccinated red wolves are adequately protected against diseases. The diseases of greatest concern are canine distemper (Genus Morbillivirus; CDV), canine parvovirus (Genus Parvovirus; CPV1, CPV2), leptospirosis (Genus Leptospira), hemobartonellosis (*Haemobartonella canis*), borrelliosis (Lyme disease, *Borrelia* sp.), demodectic mange (*Demodex canis* mites). sarcoptic mange (*Sarcoptes scabiei* mites), heart worm (*Dirofilaria immitis),* and rabies (Genus Lyssavirus. rabies virus) (Brzeski et al. 2015). The impacts of CPV2 parvovirus on pup survival in the Great Smoky Mountains National Park re-introduction area eventually contributed to the termination of that project. Fortunately, to date, none of these diseases have occurred at sufficiently high levels to cause an epidemic. However, mange (n = 26; *Sarcoptes* and *Demodex* spp.), and heartworm (n = 7) have been confirmed as repeated sources of red wolf mortality in the re-introduced population. New threats also are becoming more prevalent in local domestic dogs, including the Lyme disease-causing bacteria *Borrelia burgdoferi* (Brzeski et al. 2015).

Examination of overall mortality trends in the NEP does not suggest any significant trends. The percentage of total mortalities as compared to population estimates is relatively steady over time. However, the seasonality of these losses and the demographics of the animals lost could impact population dynamics within the NEP. Declining monthly survival rates during the fall into winter are alarming as this time coincides with red wolf pre-breeding and breeding seasons. The loss of breeders can disrupt these dynamics and has potential implications for affecting successful breeding and reproduction events (Hinton et al., in press).

Additionally, high rates of mortality have been correlated with increased hybridization rates with coyotes for eastern wolves and red wolves (Bohling and Waits 2015, Hinton et al., in press, Rutledge et al. 2010, 2012). Therefore, mortality of red wolf breeding pairs during autumn may disproportionately affect population persistence by disrupting social cohesiveness and increasing disbandment of red wolf packs prior to the winter breeding season. This is particularly troubling for conservation strategies because red wolves will form congeneric breeding pairs with coyotes when red wolf mates are not available (Bohling and Waits 2015, Gese et al. 2015, Hinton et al., in press). In other words, the simultaneous loss of red wolves and the destruction of red wolf packs by mortality increases contact between red wolves and coyotes seeking mates prior to the breeding season that results in congeneric pair formations. As a result, hybridization disrupts red wolf reproduction necessary to offset mortality and further exacerbates the negative effects caused by anthropogenic mortality.

The recovery and restoration of red wolves requires the careful management of coyotes and occasionally red wolf-coyote hybrids within the NEP. The non-native coyotes spread across the eastern USA, reaching NENC in the early to mid-1990s. It soon was recognized that interbreeding between red wolves and coyotes would produce hybrid offspring resulting in coyote gene introgression into the wild red wolf population, and that this introgression would threaten the restoration of red wolves. An adaptive management plan (Kelly et al. 1999, Fazio et al. 2005, Stoskopf et al. 2005, Rabon et al. 2013,) was developed to reduce interbreeding and introgression while simultaneously building the red wolf population. The adaptive management plan effectively uses techniques to capture and sterilize hormonally intact coyotes via vasectomy or tubal ligation, then releases the sterile canid at its place of capture to act as a territorial "placeholder" until the animal is replaced by wild red wolves. Sterile

coyotes are not capable of breeding with other coyotes, effectively limiting the growth of the coyote population, nor are they capable of interbreeding with wild red wolves, limiting hybridization events. In addition, the sterile canid will exclude other coyotes from its territory. Ultimately, the placeholder coyotes are replaced by the larger red wolves either naturally by displacing the coyote or via management actions (e.g., removal of the coyote followed by insertion of wild or translocated wolves).

The NEP is subject to annual tropical storm activity, and red wolves and their prey are vulnerable to sea level rise and flooding. In 2003 Hurricane Isabel resulted in the death of two captive red wolves located within the Recovery Area, and in 2012 Hurricane Sandy resulted in the death of one captive red wolf located within the Recovery Area (Bartel and Rabon 2013). It is possible that tropical storms could kill wild red wolves. The average elevation of most of the Recovery Area is 2-3 feet above sea level, with much of the area subject to land subsidence due to the deterioration of peat soils (USACE and NCDOT 2012). Even a modest amount of sea level rise (6 cm) would regularly inundate a significant portion of the Recovery Area (U.S. Department of Transportation 2014).

Recent permit actions:
US 64 Improvements Project in Tyrell and Dare Counties (TIP Nos. R-2544 and R-254
TAILS # 42420-2007-F-0446-R001-NCDOT R-2544 R-2545

E. Analysis of the species/critical habitat likely to be affected

Once on the brink of extinction in the 1970s, the NEP has been restored to an estimated 50-75 individuals located within the Recovery Area situated in the Albemarle Peninsula of northeastern North Carolina. Prior to its reintroduction into the ARNWR in 1987, the red wolf as considered extirpated in the wild (USFWS 1990).

The red wolves located at the current participating facilities in the SSP captive breeding program, the selected animals transferred and introduced into the NEP, and the associated affected foster packs are the focus of this BO. The proposed action has the potential to adversely affect, both directly and indirectly, the captive population through the direct transfer process and relocation into the NEP in addition to the associated foster packs during the introduction process. This proposed action, while temporarily causing stress to the associated NEP packs, will have an overall benefit to the red wolves within the Recovery Area by increasing genetic diversity and furthering recovery goals.

There is no designated critical habitat for the red wolf.

There are no other species reviewed for this proposed action and BO.

III. Environmental Baseline

Under Section 7(a)(2) of the ESA, when considering the "effects of the action" on federally listed species, the Service is required to take into consideration the environmental baseline. The environmental baseline includes past and ongoing natural factors and the past and present impacts of all federal, state, or private actions and other activities in the action area (50 CFR402.02), including federal actions in the area that have already undergone Section 7 consultation, and the impacts of state or private actions which are contemporaneous with the consultation in process.

A. Status of the species within the action area

The action area includes the 44 participating facilities currently with the red wolf SSP network located throughout the U.S. All of the potential SSP facilities around the country are within the action area, but not all of these will have a wolf removed each year.

On average, 1-2 facilities will have 2-4 wolves removed each year (range 0-8 animals total/year). Of the current captive population of 190 animals, the potential percent of wolves taken from out of captivity would be average 1.5-2.1% of the total captive population, potentially impacting several facilities on a yearly basis. If current facilities were expanded to allow additional space availability and/or accommodate an increased breeding rate in the captive population, additional animals could be potentially exported to the wild population (Simonis et al. 2015). If a higher volume of animals is needed to establish additional wild populations, these decisions would be subject to a separate consultation and special rule-making process.

Consultation with the red wolf SSP Coordinator and advisory board can inform decisions about genetic value of pups identified for fostering into the NEP. We anticipate the effect on overall genetic diversity to be minimal for the captive population.

The addition of approximately 2-4 wolves to the NEP each year would potentially increase the restored population an average of 4%-8% increase per year (based on estimated 50-75 red wolves in NEP). These insertions could also positively affect gene diversity of the NEP.

B. Factors affecting species environment within the action area

A number of ongoing anthropogenic and natural factors listed above in the "Current Status" section of this document have been found to potentially affect the red wolf in the SSP facilities or wild NEP action areas.

The only recently authorized federal action affecting the red wolf's environment within the NEP portion of the action area is the authorized US 64 Improvements Project in Tyrell and Dare Counties (TIP Nos. R-2544 and R-2545) TAILS # 42420-2007-F-0446-R001-NCDOT R-2544/R-2545.

IV: Effects of the Action

Under Section 7(a)(2) of the ESA, "effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. The federal agency is responsible for analyzing these effects. The effects of the proposed action are added to the environmental baseline to determine the future baseline, which serves as the basis for the determination in this BO. Should the effects of the federal action result in a situation that would jeopardize the continued existence of the species, we may propose reasonable and prudent alternatives that the federal agency can take to avoid a violation of Section 7(a)(2). The discussion that follows is our evaluation of the anticipated direct and indirect effects of the proposed project. Indirect effects are those caused by the proposed action that occur later in time but are still reasonably certain to occur (50 CFR 402.02).

A. Factors to be considered

Proximity of the action: _The proposed action will occur in direct proximity with the red wolves at the SSP captive breeding facilities. Direct proximity to the wolves in these facilities is a normal operating procedure due to the captive nature and care provided at these facilities. Direct contact in the form of

handling the wolves will occur during the transfer process from the specific captive facility to the introduction with the chosen pack (in the case of fostering) or chosen area within the NEP on an as needed basis per year. Specific transfer procedures are described in detail in "Section 1: Conservation Measures" above in this BO.

Distribution: The distribution of the action will vary each year/transfer depending on the factors listed above in "Section 1: Conservation Measures". The disturbance will be located at one or more of the participating SSP facilities found in Table 1. Disturbance will also occur within the NEP when pups are introduced into specific dens during fostering events. These dens will vary in location within the NEP, depending on the selected group to accept the transferred pups, but will remain within the NEP area boundaries. When adults, juveniles, or family groups are released, special care will be taken to choose an area when reintroduction would not adversely impact an established resident pack.

Timing: For fostering events, the disturbances of the action will occur in SSP facilities primarily 2-5 days after the chosen pups are born in order to prep them for relocation into the NEP. The introduction into the NEP will occur when pups are less than two weeks of age. This is a sensitive time periods in the pups lives, but the benefits of the genetic diversity gained from the transfer and introduction into the NEP, combined with the conservation measures routinely adhered to during the transfer process minimize the overall potential negative impacts to the species from the timing of this action. Overall, reintroductions of other age classes could be modified to avoid seasons of high aggression or competition (e.g., breeding season).

Nature of the effect: The proposed action will likely have significant beneficial effects on red wolves distribution due to increased genetic diversity in the NEP, but may also have nonlethal adverse effects to the species due to the action's transfer process. The action will reduce the overall population size at the SSP facilities each time an animal is removed and transferred into the NEP. The NEP will then gain by that number of wolves introduced, so it is unlikely that there will be any net loss of the species by this action in any given year, when factoring in the normal rate of individual loss in both captive and NEP groups.

Duration/disturbance frequency:_The action may occur on a yearly basis as deemed appropriate. Fostering actions, although potentially repeating in annual frequency, will have a short duration (once a year at an average of 2 separate SSP facilities) of impact during each removal of a pup. Natal pair/packs are regularly observed at SSP facilities post-removal of pups for any abnormal behavior.

Disturbance intensity and severity:_The intensity and severity of the actions disturbance is insignificant due to the average number of animals transferred yearly being only 2-4 out of the larger SSP population of approximately 190 animals. The low percentage of removal from the SSP combined with the reintroduction to the NEP further decreases the intensity and severity of the disturbance to the population as a whole. The benefits to increased population genetic diversity will benefit the species in recovery by this action.

B. Analyses for effects of the action

Direct Effects: The action will have direct effects to the red wolves in the specific captive SSP facilities selected each year to participate in the transfer program. The direct interaction, handling and removal of wolves by humans will cause stress to the affected animals. The release of mated pairs or family groups can reduce potential stress due to disrupted social dynamics. The transfer of the captive pups or juveniles from their natal pack to the chosen NEP relocation den and/or pack, or new area will also cause potential initial stress to the animals during a sensitive lifecycle stage. However, travel duration is minimized to avoid any lapse in meals and parental care during the transfer and relocation process.

Direct effects to the selected NEP packs for transfer receipt will also occur through potential harassment and stress during captive wolf placement. For fostering events, the wild pups would be directly affected through human handling and removal from the den to allow scent transfer to the captive pups before being returned to their original den location

No intentional or direct harm will occur through the action to the species. Habitat will not be altered or destroyed by this action, and the action will be short in duration, yet annually repeated as needed. A positive and beneficial direct effect of the action will be increased population levels and genetic diversity in the NEP.

Indirect effects: Potential indirect effects of the action include the increased risk of disease due to mixing captive and wild populations, but this should be minimal as the wild population would most likely already be more exposed to most diseases or natural threats vs. the captive population wolves that would be introduced into the NEP area.

There is also an increased risk posed upon the captive transfer animals with a potentially shorter life expectancy due to red wolves in the wild generally having a shorter lifespan, more disease risks, and more natural and environmental risks than those raised in the captive SSP facilities.

The potential for temporary pack dynamic disturbance due to the introduction of captive pups into wild pack dens, while highly unlikely, may occur. This indirect effect of the action will be mitigated by the conservation measures and scent transfer process of the captive pups with the wild pups, in addition to monitoring the pack and pups.

Interrelated and interdependent actions: The effects of the action under consultation are analyzed together with the effects of other activities that are interrelated to, or interdependent with, that action. The Service does not anticipate any interrelated or interdependent effects beyond those identified and discussed elsewhere in this BO.

C. Species Response to a proposed action

Releasing adult red wolves from the captive program to initiate or supplement the wild population has encountered mixed success (Van Manen et al., 2000; Phillips et al., 2003). Tolerance to human related activity can predispose released individuals to human conflict resulting in the need to return an individual to the captive population and increased mortality risks (e.g., vehicle strikes). To reduce mortality risks with fostered animals, actions should be taken to minimize disturbance to a wild recipient dam and careful selection of a den site location with adequate habitat and access can increase the ability of consistent, direct observations of captive to wild fostered individuals. Regardless of the age when naïve individuals are introduced into a wild population, mortality risks are unavoidable in free-ranging environments. Introducing pups from captive to wild litters, does however, provide fostered individuals the benefit of learning survival skills from wild parents and also offers the valuable prospect of replacing hybrid litters, augmenting population recruitment. or promoting genetic diversity in the wild population.

Numbers of individuals/populations in the action area affected: Within captive population, the approximate numbers of individuals affected would include the number of wolves removed (average of two/year), and the captive pack(s) affected by the removal of their offspring (1-2 packs of 2-8 individuals). In the wild, these actions could potentially affect 1-2 packs of 2-10 individuals.

Sensitivity and Resilience: Red wolf packs are constantly changing and adapting within the SSP captive facilities and the wild NEP in response to multiple factors including loss of individuals from mortality,

management activities, land-use changes and others. Therefore; these wolves have a low sensitivity to the changes brought upon by this action. Red wolves in the NEP have shown strong overall resilience to change since their introduction in 1987. However, anthropogenic factors, including gunshot mortality and cumulative impacts from development are currently limiting or diminishing the potential of the restored red wolf population to regenerate or further expand (USFWS 2007).

Recovery Rate:

Population viability models have evaluated different scenarios on the effects of releasing animals from captivity into the wild population (Simonis et al. 2015). Over the past decade, the population has increased at 2.8% annual growth (λ), with an average of 31 births/year (Simonis et al. 2015). Currently, there are 225 spaces within the captive breeding population. To avoid extinction risk in the captive population, researchers recommended increasing the breeding rate, which would allow the population to continue releasing wolves (including fostering pups) to the wild population (Simonis et al. 2015). These releases should be done in excess of permanent space availability so as to minimize demographic risks to the captive population (Simonis et al. 2015). For example, if the captive population is kept at 225 spaces, but breeding rates increase to 12%, the captive population can export an average of 4.0 wolves/year over the next decade and 6.5 wolves/year thereafter (Simonis et al. 2015). However, if additional spaces are procured, the captive population should initially grow up to fill that space before releasing animals into the wild. Therefore, the projected release rate for the next decade with 330 spaces is only 0.4 wolves/year (while the population grows to fill spaces), but it quickly increases and averages 9.7 wolves/year thereafter (Simonis et al. 2015).Based on these data, it appears that past releases have not adversely affected the captive population. However, future releases should be conducted in a similar adaptive manner to minimize risks. Increasing the breeding rate in the captive population will allow the continued releasing of wolves (including fostering pups) to the reintroduction population, but releases should be done in excess of permanent space availability so as to minimize demographic risks to the ex situ population (Simonis et al. 2015).

V. Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this BO. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

The greatest cumulative effect to the captive red wolves at the SSP facilities is funding and available space to continue the captive breeding and management of these red wolves across the nation. If funding programs are reduced then this has management implications at a facility by facility level, in addition to the captive breeding program as a whole.

The greatest cumulative effect to the wild NEP is the ongoing problem of red wolves being killed by gunshot. either intentionally or by hunters mistaking red wolves for coyotes, and the resulting deaths of these red wolves. Additionally, potential land use change and residential development on privately owned lands near the NEP areas could cause a reduction of available habitat for the wild and transferred pups or fostered animals. Also, if sea level rise continues to occur as predicted. some red wolf habitat may be altered to some extent or ultimately lost.

VI. Conclusion

After reviewing the current status of the red wolf, the environmental baseline for the action area, the effects of the proposed action and cumulative effects. it is the Service's biological opinion that the

transfer of captive breed red wolf wolves from participating SSP facilities across the nation into the wild NEP in northeastern North Carolina, as proposed, is not likely to jeopardize the continued existence of the red wolf. No critical habitat has been designated for the red wolf; therefore, none will be affected.

The non-jeopardy opinion is based, in part, on the following rationale:

The red wolf captive population as a whole consists of those individuals which reside within the currently 44 participating SSP facilities nationwide. These facilities and individuals are part of the captive breeding program as appropriate funding, space and management allows. This captive population assists in providing genetic diversity to the NEP when the program is activated and funded. The captive transfer program is not currently activated as of the issuance of this BO. The wild NEP red wolves directly benefit from this program from a genetic diversity and population increase standpoint.

No mortality of red wolves is expected as a direct result of this proposed action. While there will be direct effects to the red wolves by the proposed action, the long-term genetic diversity benefits to the overall wild NEP will outweigh the temporary negatives in which this BO addresses.

Incidental Take Statement

Section 9 of the ESA and federal regulations pursuant to Section 4(d) of the ESA prohibit the taking of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Service's Red Wolf Program so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in Section 7(o)(2) to apply. The Service's Red Wolf Program has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the Service's Red Wolf Program fails to assume and implement the terms and conditions of the Incidental Take Statement the protective coverage of Sections 7(o)(2) may lapse. In order to monitor the impact of Incidental Take, the Service's Red Wolf Program must report the progress of the action and its impact on the species to the Service's Raleigh Ecological Services Field Office as specified in the Incidental Take Statement. [50 CFR §402.14(i)(3)]

Amount or extent of take anticipated:

The Service anticipates an average of 2 animals/year over a 5-year period not to exceed 8 wolves in any single year as a result of this proposed action. The incidental take is expected to be in the form of harassment resulting from the handling, capture, transfer and introduction into the NEP of the captive bred red wolves. During fostering events, harassment by handling will also occur to the NEP wild pups during the scent transfer process of introducing the captive pups into the chosen den.

Effect of the take:

In the accompanying BO. the Service has determined that this level of anticipated take is not likely to result in jeopardy to the species, or destruction or adverse modification of designated or proposed critical habitat. This potential take resulting from the action will benefit the genetic diversity of the NEP red wolves.

Reasonable and prudent measures:

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the take of the red wolf. These nondiscretionary measures include. but are not limited to, the terms and conditions outlined in this BO.

1) Implement, assess and update necessary safety measures and protocols needed to avoid and minimize incidental take associated with this action.

2) Adopt recommendations mentioned above from the 2015 PVA and limit releases to individuals that are surplus to the captive population.

Terms and conditions:

In order to be exempt from the prohibitions of Section 9 of the Act, the Red Wolf Program must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1) Annual review of the safety measures and protocols will be required by the red wolf recovery lead and updated as needed. A record of these reviews and implemented updates will be kept on file as part of the record.

2) Coordination with the red wolf SSP Coordinator and advisory board to determine how many animals are available in a given year. Participation in the annual SSP meeting to discuss potential transfers with the facilities will greatly benefit these discussions. The knowledge of the advisory board can help inform decisions about genetic value of wolves identified for fostering into the NEP and the potential impacts of releases on the captive population.

Coordination of incidental take statements with other laws, regulations, and policies

Under Section 10(j) of the ESA. the Service is authorized to introduce an "experimental population" of a listed species outside the species' current range, but within its historic range, if the Service determines that such a release would further the conservation of the species. Congress added Section 10(j) to the ESA in 1982 in response to testimony by state fish and wildlife agencies.

Section 10(j) defines an NEP as a population that the Service has determined is not essential to the continued existence of the species. For the purposes of Section 7 of the ESA, which includes federal agency actions and consultations, a NEP is treated as a species proposed for listing. however, when it occurs on National Wildlife Refuge System or National Park System lands it is treated as a threatened species. Under Section 10(j), an NEP shall be treated as a threatened species for the purposes of Sections 4(d) and 9 of the ESA, which regulate the take of listed species. Therefore, take of the species may only occur as provided in the special (4(d)) rule set forth at 50 C.F.R. § 17.84(c).

Reinitiation/Closing Statement:

This concludes formal consultation on the action(s) outlined in the Intra-Service request. As provided in 50 CFR§402.16, reinitiation of formal consultation is required where discretionary Federal Agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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Table 1. Current participating Red Wolf Species Survival Plan institutions and current red wolf demographics as of April 1, 2015.

Institution	City, State	Type	Males	Females	Total
Akron Zoological Park	Akron, OH	AZA	0	2	2
Alexandria Zoological Park	Alexandria, VA	AZA	0	1	1
Alligator River NWR	Manteo, NC	Non-AZA	2	4	6
Beardsley Zoological Gardens	Bridgeport, CT	AZA	1	1	2
Brevard Zoo	Melbourne, FL	AZA	0	2	2
Cape Romain NWR	Awendaw, SC	Non-AZA	2	3	5
Charles Towne Landing State Historical Site	Charleston, SC	Non-AZA	0	3	3
Chehaw Wild Animal Park	Albany, GA	AZA	2	2	4
Dan Nicholas Nature Center	Salisbury, NC	Non-AZA	0	2	2
Endangered Wolf Center	Eureka, MO	AZA	2	2	4
Forth Worth Zooling Park	Fort Worth, TX	AZA	1	1	2
Fossil Rim Wildlife Center	Glen Rose, TX	AZA	1	1	2
Fresno Chaffee Zoo	Fresno, CA	AZA	3	1	4
Great Plains Zoo	Sioux Falls, SD	AZA	1	1	2
Henson Robinson Zoo	Springfield, IL	AZA	1	1	2
Homosassa Springs Wildlife State Park	Homosassa Springs, FL	Non-AZA	1	1	2
Jackson Zoological Park	Jackson, MS	AZA	5	4	9
Jacksonville Zoological Gardens	Jacksonville, FL	AZA	1	1	2
Knoxville Zoological Gardens	Knoxville, TN	AZA	2	2	4
Land Between the Lakes	Golden Pond, KY	Non-AZA	1	2	3
Lincoln Park Zoo	Chicago, IL	AZA	1	1	2
Lowry Park Zoological Garden	Tampa, FL	AZA	1	1	2
Mill Mountain Zoo	Roanoke, VA	AZA	1	3	4
Miller Park Zoo	Bloomington, IN	AZA	1	1	2
Niabi Zoo	Coal Valley, IL	Non-AZA	1	1	2
North Carolina Museum of Life & Science	Durham, NC	Non-AZA	1	1	2
North Carolina State University Center for Veterinary Medicine	Raleigh, NC	Non-AZA	2	5	7
North Carolina Zoo	Asheboro, NC	AZA	5	4	9
Northeastern Zoo	Green Bay, WI	AZA	5	2	7
Point Defiance Zoo & Aquarium	Tacoma, WA	AZA	15	29	44
Red Wolf Health Care & Education Facility (Pocosin Lakes NWR)	Columbia, NC	Non-AZA	3	2	5
Reflection Riding Arboretum & Nature Center	Chattanooga, TN	Non-AZA	3	3	6

Roger Williams Park Zoo	Providence, RI	AZA	1	1	2
Rosamond Gifford Zoo	Syracuse, NY	AZA	1	0	1
Ross Park Zoo	Binghampton, NY	Non-AZA	0	3	3
Salisbury Zoological Park	Salisbury, MD	AZA	1	[illegible]	2
Tallahassee Museum of Natural History	Tallahassee, FL	Non-AZA	2	2	4
Texas Zoo	Victoria, TX	Non-AZA	0	1	1
Trevor Zoo	Millbrook, NY	AZA	2	1	3
Virginia Living Museum	Newport News, VA	AZA	3	0	3
Western North Carolina Nature Center	Asheville, NC	AZA	2	0	2
Wildlife Science Center	Forest Lake, MN	Non-AZA	1	2	3
Wolf Conservation Center	South Salem, NY	Non-AZA	3	4	7
Wolf Haven International	Tenino, WA	Non-AZA	2	2	4
Totals			83	107	190

Red Wolf
(Canis rufus)

5-Year Status Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Southeast Region
Red Wolf Recovery Program Office
Alligator River National Wildlife Refuge
Manteo, North Carolina

September 28, 2007

5-Year Status Review
Red Wolf (*Canis rufus*)

Table of Contents

5-YEAR STATUS REVIEW

Red Wolf (*Canis rufus*)

1. GENERAL INFORMATION

1.1. Reviewers

Lead Region:	Kelly Bibb, Endangered Species, Southeast Region, USFWS, (404) 679-7132
Lead Field Office:	Bud Fazio, Team Leader Red Wolf Recovery Program, Manteo, North Carolina (NC), (252) 473-1131, ext. 241
Cooperating Offices:	Will Waddell, Coordinator Red Wolf Species Survival Plan / Point Defiance Zoo and Aquarium (PDZA), Tacoma, WA (NWR = National Wildlife Refuge) St. Vincent NWR, Florida Cape Romain NWR, South Carolina Alligator River NWR, NC Pocosin Lakes NWR, NC Mattamuskeet NWR, NC Ecological Services Field Office, Raleigh, NC
Peer Reviewers:	Tim Langer, Ph.D, Bear Biologist, Appointed Commissioner, North Carolina Wildlife Resources Commission, Raleigh, NC Rolf O. Peterson, Ph.D, Wolf Ecology, Michigan Technological University, Houghton, MI Michael R. Vaughan, Ph.D, Population Dynamics and Ecology, Virginia Polytechnic Institute and State University. USGS-BRD Coop. Wildl. Res. Unit, Blacksburg, VA. See Appendix A for a complete list of peer reviewers and more details about their comments and the peer review process.

1.2 Methodology used to complete the review

This review was completed by Bud Fazio, Team Leader of the Red Wolf Recovery Program. The review was completed with assistance from field biologists of the Program, from other U.S. Fish and Wildlife Service (Service or USFWS) field stations, and from the Red Wolf Species Survival Plan Coordinator listed in Section 1.1 above. In addition to in-house reviews by Service experts, this document was peer reviewed. Peer reviewers provided individual, written responses that addressed scientific aspects of the 5-year review, but did not include review of the recommendation on status (refer to Appendix A). No part of this review was contracted to outside parties. All documents and literature used for this review are on file in the Red Wolf Recovery Program office located at Alligator River NWR headquarters in northeastern NC. Information used in constructing this review includes the recovery plan, species survival plan, and adaptive management work plan guiding red wolf field activities. Additional information used includes peer-reviewed manuscripts, symposium proceedings, technical reports, Service reports, published papers and notes and communications from other qualified biologists who have knowledge of red wolves and their habitat requirements. The public notice for this review was published on September 20, 2005, with a 60 day comment period (70 FR 55157).

1.3. Background

1.3.1. FR Notice citation announcing initiation of this review:

70 FR 55157, September 20, 2005

1.3.2. Listing history

Original Listing
FR notice: 32 FR 4001
Date listed: March 11, 1967
Entity listed: Species
Classification: Endangered

1.3.3. Associated rulemakings

Determination of Experimental Population Status for an Introduced Population of Red Wolves in North Carolina and Tennessee, 56 FR 56325, November 4, 1991.

Determination of Experimental Population Status for an Introduced Population of Red Wolves in North Carolina, 51 FR 41790, November 19, 1986.

Two non-essential experimental red wolf populations (NEP) were designated in North Carolina and Tennessee (Parker and Phillips 1991). One population was established in 1991 in the Great Smoky Mountains National Park of eastern Tennessee and western North Carolina; this population was discontinued in 1998 primarily due to poor pup survival caused by domestic dog disease (Henry 1998). The other population began in 1987 on the Albemarle Peninsula of northeastern North Carolina near the Outer Banks region; this population is currently the only population of red wolves known to exist in the wild. (See section 2.3.2.4 for details on the NEP designation under the Endangered Species Act).

These regulations below describe special flexible regulations for people living in the vicinity of the two experimental populations.

Revision of the Special Rule for Nonessential Experimental Populations; 60 FR 18940, April 13, 1995.

Determination of Experimental Population Status for an Introduced Population of Red Wolves in North Carolina and Tennessee, 58 FR 52031, October 6, 1993.

1.3.4. Review history

Recovery/Species Survival Plan: 1990

Recovery Data Call: 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007

5-year review: November 6, 1991 (56 FR 56882) in this review, species were simultaneously evaluated with no in-depth assessment of the five factors as they pertained to the species' recovery. The notices summarily listed these species and stated that no changes in the species' status were appropriate at this time. In particular, no changes were recommended for the status of the red wolf.

5-year review: July 22, 1985 (50 FR 29901)

Various documents that have reviewed red wolf status since the last 5-year review are on file in the Red Wolf Recovery Program office. For example, see Kelly et al. (1999, 2004), Phillips (1995) and Phillips et al. (1995, 2003, 2004).

1.3.5. Species' Recovery Priority Number at start of review (48 FR 43098)

The red wolf has a Recovery Priority Number of 5C, indicating a species with a high degree of threat and a low potential for recovery.

1.3.6. Recovery Plan

The current *Red Wolf Recovery/Species Survival Plan* was approved in 1990 as a revised edition (USFWS 1990). The original and revised *Red Wolf Recovery Plans* (USFWS 1982, 1984) were approved when the only known remaining red wolves were held in captivity. These early versions of the plan were drafted after the Service and scientists realized red wolves were likely extinct in the wild by late 1980 (McCarley and Carley 1979; Service 1984, 1993), and before restoration efforts began in 1987 (Phillips and Parker 1988; Phillips 1994) at the Alligator River NWR.

1.3.7. Species Status: Declining short-term (2006 and 2007 Recovery Data Calls), but recorded as Improving long-term.

1.3.8. Recovery Achieved: 2 = 26% to 50% recovery objectives achieved (2007 Recovery Data Call)

2. REVIEW ANALYSIS

2.1. Application of the 1996 Distinct Population Segment (DPS) policy

The red wolf is not listed as a DPS. We currently recognize the red wolf as the species *C. rufus*. Some scientists (Wilson et. al 2000, 2003) believe the red wolf and the Algonquin wolf (*C. lupus lycaon*) should be classified together and renamed the eastern wolf (*C. lycaon*). If scientific consensus on the concept of the eastern wolf is reached, some justification may develop (Kyle et al. 2007, but see Murray and Waits 2007) for the Service to consider the red wolf a DPS of *C. lycaon* in the future. However, scientific consensus has not yet been achieved, so we currently recognize the red wolf as the species *C. rufus* (Audubon and Bachman 1851; Goldman 1937, 1944; Nowak 2002) with no DPS at this time. See Section 2.3 for discussion and updates regarding the genetics, origin, and taxonomy of the red wolf.

2.2. Recovery Criteria

The red wolf has a final approved recovery plan that contains objectives that are measurable (USFWS 1990). The recovery plan does not reflect the best available information on the biology and habitat of its species. (See section 4.0 for recommendations to revise the plan). However, the recovery objectives still apply and can be used with new information to show how recovery actions have reduced threats to this species. (See section 2.3.1. for updates on progress in biology and habitat of red wolves.)

The current recovery plan (USFWS 1990) specifies the following objectives listed below.

1) Objective: Establish and maintain at least three red wolf populations via restoration projects within the historic range of the red wolf. Each population should be numerically large enough to have the potential for allowing natural evolutionary processes to work within the species. This must be paralleled by the cooperation and assistance of at least 30 captive breeding facilities in the U.S.

Progress: The Service has established and maintained one wild red wolf population via collaboration with partners and local communities on the Albemarle Peninsula in North Carolina. We currently have red wolves at 40 captive breeding facilities across the United States, but additional facilities are needed to expand the captive population as defined under objective 3 below.

2) Objective: Preserve 80% to 90% of red wolf genetic diversity for 150 years.

Progress: Via species survival plan coordination through the Association of Zoos and Aquariums (AZA), captive breeding program cooperators currently maintain 89.65 percent of red wolf genetic diversity expressed in the original founder population (Long and Waddell 2006).

3) Objective: Remove threats of extinction by achieving a wild population of approximately 220 wolves and a captive population of approximately 330 wolves.

Progress: The wild red wolf population in North Carolina fluctuates between 100 and 130 wolves in annual calendar year counts that are not necessarily population estimates. Field data from known wild red wolves since 1999 suggest a minimum wild red wolf population size which fluctuates between 80 and 100 wolves. We currently have 208 red wolves (90 males, 113 females, 5 unknown pups) at 40 captive breeding facilities across the United States, but additional facilities are needed to reach the objective of 330 red wolves in captivity. (See section 4, Recommendations for Future Actions).

4) Objective: Maintain the red wolf into perpetuity through embryo banking and cryogenic preservation of sperm.

Progress: Via species survival plan coordination through the Association of Zoos and Aquariums (AZA), reproductive studies focusing on semen collection and processing, cryopreservation, non-invasive evaluation of female reproductive cycles, and artificial insemination have resulted in steady progress (Goodrowe et al. 1998, 2000a, 2000b, 2001; Koehler et al. 1994, 1998; Lockyear 2006; Walker et al. 2002), but additional work to improve and refine techniques is ongoing.

2.3. Updated Information and Current Species Status

See Appendix B for a description of red wolf conservation efforts before 2000.

2.3.1. Biology and Habitat

a. New Interpretations of Red Wolf Historic Range

Today, the majority of authors still agree that red wolves occurred historically in the United States from south central Texas to Florida, and north to the Ohio River (Nowak 1979). Nowak (1995) extended the historic range of red wolves into Pennsylvania, and Nowak (2002) extended the range into New England as far as south central Maine. Nowak (2002) also suggested that red wolves may have extended historically into eastern Canada, blending with gray wolves to create the Algonquin wolf (*C. lupus lycaon*). Lending support to Nowak's suggestion, or otherwise to the concept of the eastern wolf (*C. lycaon*), Wilson et al. (2003) described historic museum samples labeled in the late 1800's as gray wolves from New England, but found they contained new world DNA, not gray wolf DNA, that some scientists interpret to be coyote-like DNA.

Post-colonial information documents the presence of wolves in New England (Cronan 2003; Krohn 2006, Univ. of Maine, unpublished data), but which wolf species occurred there historically is subject to further discussion. Physical specimens and pre-Columbian information are scarce for New England, so a combination of reasoning, science, historic accounts and minimal physical evidence potentially support the occurrence of red wolves (*C. rufus*, Nowak 2002), eastern wolves (*C. lycaon*, Wilson et al. 2000, 2003; Kyle et al. 2007), or gray wolves (*C. lupus*, Foster et al. 2002, Paquet et al. 1999; Wydeven et al. 1998). Occurrence of these three kinds of wolves in New England may have differed over geologic time. Yet, reasoning based on the ecology of wolves and their prey leads us to believe the northeastern United States and southeastern Canada were likely a contact zone between the smaller red wolf in the south and the larger gray wolf in the north (Amaral 2007 *in litt.*). This north/south interface likely occurred where the northern edge of mixed coniferous-deciduous forest with smaller prey (white-tailed deer) met the southern edge of boreal forest with larger prey (moose, caribou, elk). Areas of overlap could have brought the two wolves together in evolutionary time to form the eastern wolf, but full scientific consensus has not yet been reached regarding the eastern wolf concept.

b. Three Hypotheses - Updates of Red Wolf Origin and Taxonomy

The Service currently recognizes the red wolf as the species *Canis rufus*. Species status is supported in part by recent genetic findings where mtDNA sequencing of 340 base pairs of the control region revealed a unique sequence (haplotype) in red wolves that has not been observed in coyotes, gray wolves, or dogs (Adams 2002; Adams et al. 2003a); this DNA sequence differed from coyote sequences by 4 to 34 base pair changes. Species status is also supported by morphological, paleontological and other data described and discussed by Goldman (1937, 1944), by Henry (1992), by McCarley (1962), by Nowak (1979, 1992, 1995, 2002), by Nowak and Federoff (1996, 1998), by Nowak et al. (1995), and by Paradiso and Nowak (1971, 1972).

Nowak (2002) suggested the red wolf is the original small wolf of the eastern United States, descended from the Eurasian wolf (*Canis mosbachensis*). Small North American descendents of the Eurasian wolf became isolated by glaciation, leaving the red wolf to persist 10,000 years into the 20th Century. Reich et al. (1999) suggested the red wolf resulted from natural evolutionary hybridization between gray wolves and coyotes up to 12,000 years ago. Wilson et al. (2000) suggested red wolves, Algonquin wolves (*C. lupus lycaon*), and coyotes diverged in a separate line of evolution away from gray wolves approximately 1.2 million years ago, followed by divergence of coyotes away from red and Algonquin wolves approximately 150,000 to 300,000 years ago. Hedrick et al. (2000, 2002, and 2004) showed major histocompatibility complex genetics data which indicates red wolves are more closely related to coyotes than to gray wolves.

Red wolves were originally described by Audubon and Bachman (1851) as a subspecies (*rufus*) of the gray wolf (*C. lupus*), and reasoning supporting this possibility is provided by Phillips and Henry (1992). Goldman (1937, 1944) combined *rufus* with other wolves of the southeast USA to form the distinct species of red wolf (*C. rufus*) separate from gray wolves. Numerous other studies supported Goldman's suggestions until approximately 1990. With the onset of applied genetic techniques came new hypotheses suggesting the red wolf evolved via natural evolutionary hybridization between gray wolves and coyotes (Roy et al. 1994, 1996; Wayne and Jenks 1991; Wayne 1992; Wayne and Gittleman 1995; Wayne et al. 1998; Reich et al. 1999; but see Gardner 1998 and Mech 1970).

Wilson et al. (2000, 2003) suggested the red wolf and Algonquin wolf are similar enough genetically to be combined into one species newly named the eastern wolf (*C. lycaon*). Kyle et al. (2006, 2007) supported the hypothesis, recognizing the eastern wolf as taxonomically distinct from gray wolves and coyotes. Murray and Waits (2007) debated with Kyle et

al. (2007) about potential management implications for red wolves, considering their possible conspecific relationship with Algonquin wolves. We await further scientific data, discussion, debate and consensus for consideration concerning the taxonomic and related management status of red wolves.

See Appendix C for additional notes on the origin, taxonomy, genetics and management of the red wolf NEP.

c. Red Wolf Genetics and Management

Conservation of the red wolf gene pool and associated genetic fitness are primary concerns in the red wolf recovery and species survival plan (USFWS 1990). The current red wolf captive breeding program began with 14 founders. With very small populations, survival can be affected by genetic drift (random loss of genetic diversity) and inbreeding depression (i.e., increased genetic homozygosity and subsequent expression of deleterious genes). Genetic diversity of less than 90 percent in founder populations can result in compromised reproduction (Garelle et al. 2006). Gene diversity in the current captive red wolf population is approximately 89.65 percent of that in the founder population (Long and Waddell 2006). Kalinowski et al. (1999) reports no inbreeding depression in the red wolf captive program. However, physical anomalies have been observed in a small number of captive and wild red wolves such as progressive retinal atrophy, malocclusion and undescended testicles (Waddell, pers. comm. 2007). Yet, steady progress is being made in red wolf reproductive research (section 2.2) in the captive breeding program that includes two red wolf litters produced in 1992 and 2003 via artificial insemination (Lockyear 2006).

Kelly et al. (1999) recognized that interbreeding between eastern coyotes and red wolves produces hybrids and results in coyote gene introgression into the wild red wolf population. To reduce introgression and interbreeding while simultaneously building a restored red wolf population, an adaptive management work plan was developed (Kelly 2000; Fazio et al. 2005). The adaptive plan effectively uses techniques similar to Bromley and Gese (2001) to sterilize hormonally intact coyotes and hybrids via vasectomy and tubal ligation, then use them as territorial “place-holders” until replaced by wild red wolves. “Placeholder” canids will not interbreed with wild red wolves, and they exclude other coyotes or hybrids from the territory they hold. Ultimately, the “place-holder” canids are replaced by red wolves either naturally (e.g. displacement) or via management actions (e.g., removal followed by pairing wild or translocated wolves into the territory). The adaptive plan is effective because we utilize newly developed non-invasive, genetics-based techniques to identify canids in the field (Adams 2002, 2006; Adams and

Waits 2007; Adams et al. 2003a, 2007; Waits 2004; Waits and Paetkau 2005), incorporating methods developed by Miller et al. (2002, 2003).

We have effectively reduced interbreeding and coyote gene introgression using the adaptive plan and associated non-invasive techniques, all with assistance from scientists on the Red Wolf Recovery Implementation Team (Adams 2006, Beck 2005, Stoskopf et al. 2005). Early models by Dr. Phil Hedrick in 2001 showed sterile hybrids function as effective "place holders." Modeling by Hedrick in 2002 projected another 60 years of adaptive management would bring the red wolf NEP to the level of 99% red wolf genes, effectively reducing coyote gene introgression to acceptable biological levels (1%). Hedrick's projection implied dramatic improvement in the restored red wolf population over the former 15% coyote gene introgression reported by Kelley et al. (1999). Further simulation modeling by Frederickson and Hedrick (2006) confirmed our sterilization method can be effective, but also emphasized long-term reproductive barriers are important, especially assortative mating and red wolf challenges to coyotes or hybrids. To date, red wolf biologists have documented 32 events since 1993 where a red wolf displaced or killed a non-wolf (coyote or hybrid). In contrast, red wolf biologists and Red Wolf Recovery Implementation Team scientists have not been able to document any evidence of reciprocal activity (i.e. usurpation or killing of red wolves) by coyotes or hybrids.

Advances in genetics and associated field techniques provide new information helpful in managing wild red wolves. Using data on grizzly bears (*Ursus arctos),* Miller and Waits (2003) demonstrated that only a small number of individuals per generation are needed to maintain sufficient genetic diversity in a carnivore population, and we believe this to be true also for red wolves. Adams (2006) noted strong evidence that a single hybridization event in 1993 resulted in most introgression of coyote genes into the red wolf population observed to date. From this evidence, Adams (2006) infers that hybridization with coyotes has had less genetic impact on the restored red wolf population than originally thought by Kelly et al. (1999), largely because backcrossing has been rare in the population.

d. Dynamics of the Restored Red Wolf Population

Recent calendar year counts for red wolves in the wild population fluctuate between approximately 100 to 130 red wolves, depending on births, deaths, related social dynamics, and other factors (Figure 1; Table 1; see also section 2.3.2.). Field data from known wild red wolves since 1999 suggests a minimum red wolf NEP size which fluctuates between 80 and 100 wolves. The number of breeding social groups maintaining territories rose to 22 in 2004, fell to 15 in 2005 and 2006, then rose to 20 in 2007 (Figure 4, below).

Table 1 and Figures 1, 2, 3 and 4, below, show upward trends in red wolf population parameters (i.e. calendar year counts for adults and pups born, wolf litters, and breeding pairs over time). Table 1 and Figure 1 show the annual calendar year counts of red wolves in the NEP (D. Murray 2007, unpublished data; Service 2007, unpublished data). Table 1 and Figure 1 also contain separate data describing the number of red wolf pups born each calendar year, as tracked by red wolf biologists during field activity (Service 2007, unpublished data). Note that the numbers in Table 1 represent animals known to be alive during a given calendar year, and therefore do not constitute an actual population size estimate. Figures 2 and 3 show the upward trend in number of red wolf litters born annually, while Figure 3 shows the low occurrence of hybrid litters subsequently removed once found (Service 2007, unpublished data). Figure 4 shows a rise in number of red wolf breeding pairs over time (Service 2007, unpublished data).

Table 1. Annual calendar year counts of red wolf adults and pups for free-ranging red wolves in eastern North Carolina (1990 to 2006).

YEAR	NUMBER OF RED WOLVES	PUPS
1990	18	3
1991	27	13
1992	26	5
1993	44	16
1994	78	35
1995	74	23
1996	70	16
1997	85	21
1998	95	12
1999	126	37
2000	128	25
2001	131	37
2002	123	33
2003	119	39
2004	125	55
2005	115	41
2006	114	51

Figure 1. Annual counts of free-ranging red wolves in North Carolina (1990 through 2006) are shown in red with square marks. Annual counts of pups are shown in blue with diamond marks. Annual counts do not constitute actual population size estimates.

Figure 2. Number of known red wolf pups born annually from 1987 to 2007. The blue line (diamonds) and the red line (squares) indicate the number of pups respectively born before and after adaptive management plan implementation.

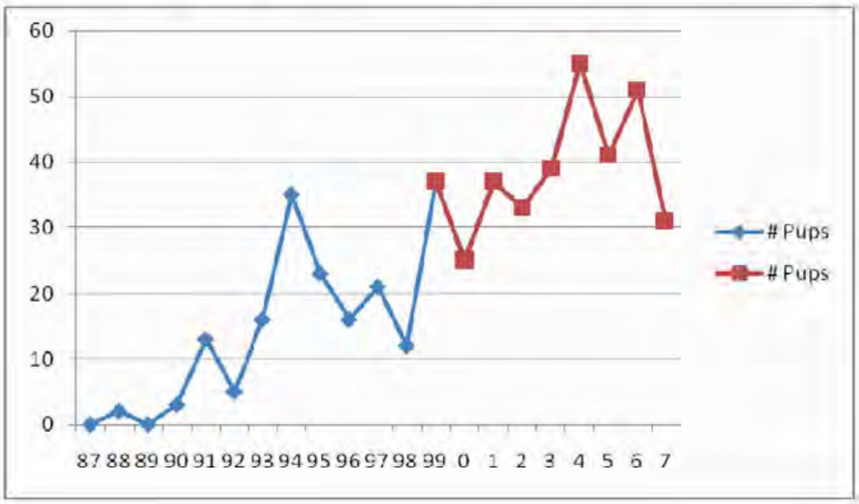


Figure 3. Annual number of litters found from1988 to 2007. The gold (tall) bars indicate red wolf litters, while the red (short) bars indicate hybrid litters detected. Hybrid litters were promptly removed from the red wolf population area.

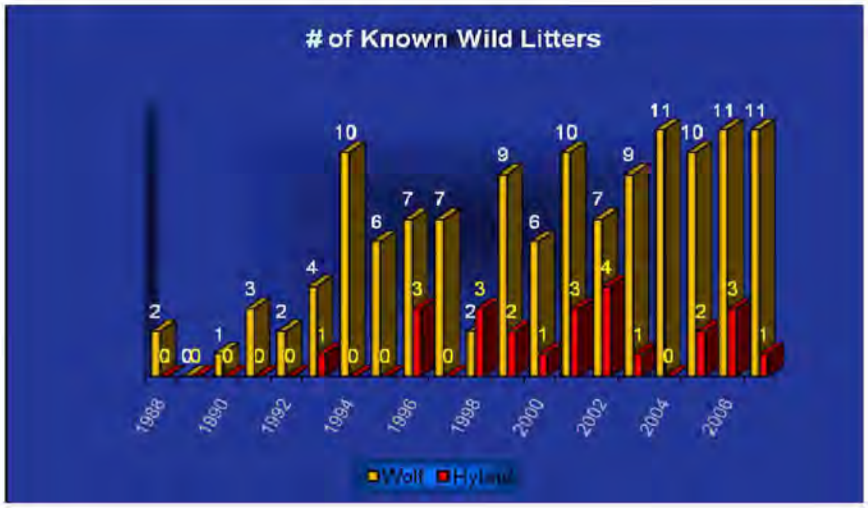


Figure 4. Annual number of known red wolf breeding pairs from 1987 to 2007.

Red wolf biologists recorded a total of 495 pups born between 1987 and 2007. Figure 2 shows 146 pups were born prior to, with 349 pups born after, implementation of the adaptive management work plan in late 1999 and early 2000 (Kelly 2000, Fazio et al. 2005). In 2007, 31 red wolf pups were born (Figure 2), a decline of 20 pups compared to 51 pups the previous year. Murray (2007, unpublished data) reported litter sizes are largest among adult breeding pairs approximately 5 to 6 years old. The Service noted a significant milestone achieved in winter of 2002, when Service data showed all red wolves in the NEP at that time were actually born in the wild. In other words, the wild NEP no longer contained captive-born nor island-born red wolves in early 2002; the NEP was reproducing in the wild on its own without augmentation by the Service.

Excluding uninhabitable locations rigorously surveyed, roughly two-thirds of the five-county red wolf NEP area (i.e. the Albemarle Peninsula, hereafter called Peninsula) is currently occupied by red wolf territories. (See section 2.3.2.4 for further details.) Red wolf field biologists believe there is enough space available on the western end of the Peninsula for wild red wolves to establish additional territories, though some of the remaining habitat may be of low quality. Yet, Stoskopf (2007 *in litt.*), Murray (2007 *in litt.*), and Knowlton (2007 *in litt.*) suggest the wild red wolf population may have reached its functional carrying capacity with little room for significant additional numbers of wolves on the Peninsula, noting that suitability of remaining habitat may be poor. If this is true, the red wolf NEP will fall below the 220 wolves identified in the recovery plan as a population objective, making additional population release sites necessary to achieve further red wolf restoration and recovery. (See section 4.)

Recognizing the limitations of the counts in Table 1 in accurately reflecting actual red wolf wild population size, we can inform our general understanding of population status by fitting growth models to time series (D. Murray 2007, unpublished data). Of the four models under consideration (density-independent, logistic density-dependent, theta-logistic density-dependent, inverse density-dependent), superior fit was obtained from the linear density dependent model for both the total number of wolves (column 2 in Table 1, corresponding to maximum population count), and total number excluding pups (column 2 minus column 3 in Table 1, corresponding to number of yearlings and adults only in the population). For the total count, intrinsic rate of increase (r_{max}) for the population is 0.346 (0.037, 0.655; 95% CI) which is generally comparable to rates of increase observed in other wolf populations (see Fuller et al. 2003); this rate is also similar to population growth recently observed in gray wolves translocated to Yellowstone National Park and central Idaho. In this exercise, the estimated carrying capacity (K) of red

wolves in the NEP is 138.7 (66.0, 211.4), which implies that the population reached its plateau in 2001. However, we remind that this estimate should be considered highly qualitative given the uncertainty associated with the population time series used to generate the growth curve. We also note that in 2001 approximately 40% or more of the Peninsula land area was not yet occupied by red wolf territories, leading us to believe population expansion would continue in subsequent years. Additional analysis of red wolf population status, using demographic population projections and habitat suitability thresholds, likely will provide a more robust red wolf population status assessment.

Preliminary population viability analyses revealed early estimates of survival for the red wolf NEP (D. Murray 2004, unpublished data). Annual survival rates in the wild NEP were 78.2% overall, with adults (80.6%), pups (67.8%), and yearlings (79.3%) all showing high survival rates that reflected a stationary or increasing red wolf population (Figure 5). Annual survival rates for male (76.8%), female (79.6%), wild born (83.6%), island-reared (67.3%), and captive-reared (56.8%) red wolves were also reported (Figure 6). The survival rates for lone red wolves (66.8%) differed sharply from red wolves in a group (81.3%).

Figure 5. Survival rates of wild red wolves (D. Murray 2004, unpublished data). Rates are high relative to other canid species.

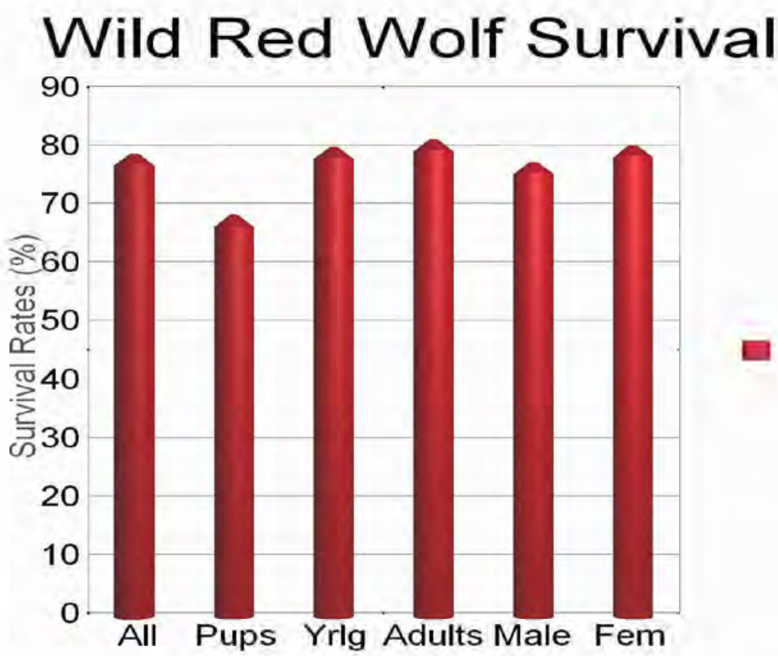
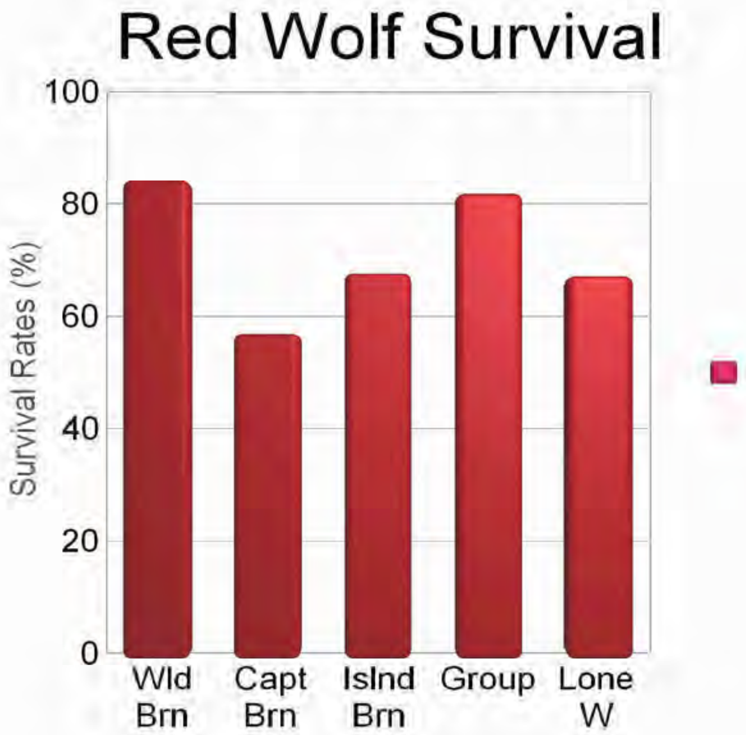


Figure 6. Survival rates of specific red wolf cohorts (D. Murray 2004, unpublished data). Wild born red wolves showed higher survival than captive born or island born red wolves. Red wolves in a group showed higher survival than lone wolves.



New survival figures will be calculated and published from on-going population viability analyses by Dr. Murray and colleagues during the next few years. Currently, correlates of red wolf survival, productivity, and dispersal (i.e., genetic factors, habitat occupation patterns, demographic attributes) are being examined via model selection and multi-model inferences to better understand determinants of red wolf population status in North Carolina. A discussion of population viability analyses performed as part of recovery planning can be found in Morris et al. (2002).

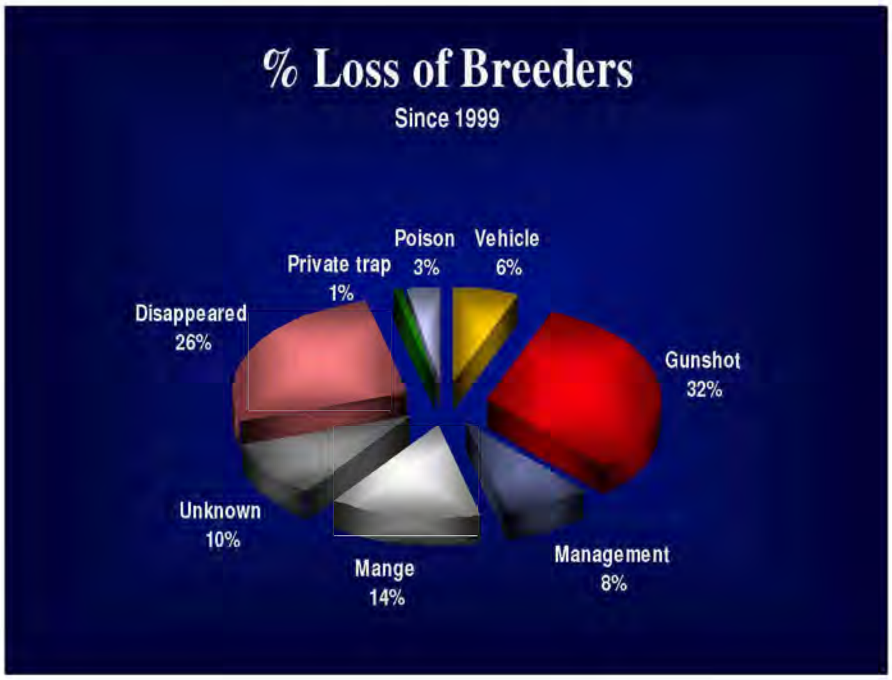
From 270 known red wolf losses in the NEP during the time period of September 1987 through January 2007, figures were calculated (D. Murray 2007, unpublished data) which showed proportions of red wolves lost to vehicle strikes (17.4%), illegal/incidental activity (19.2%), natural causes (22.2%), unknown causes (19.2%), and management actions (21.1%). From 166 known red wolf losses in the NEP during the period of

1999 through 2006, figures were calculated (Service 2007, unpublished data) which showed proportions of red wolves lost (Figures 7, 8, 9) to gunshot (22%), disappearance (22%), vehicle strikes (14%), management (13%), unknown causes (11%), mange disease (8%), intraspecific aggressions (wolves killing wolves, 5%), poison (3%) and accidental loss during private trapping activity (2%). Preliminary analysis shows the majority of management mortality is accounted for by trapping incidents (e.g., drowning, injury, etc.) and by changes in genetics identification methods earlier in the program. We used 8 known gene loci to identify canids earlier in the program, whereas we used 19 loci to identify canids later. This change in known loci informed us some canids formerly identified as hybrids were unfortunately wolves euthanized before newer identification methods became available. Overall, Figure 8 shows gunshot and disappearance are the leading losses among 67 red wolf breeders, while Figure 9 shows the leading losses of 99 red wolf non-breeders are vehicle strikes, gunshot and disappearance. A breeder is a paired adult wolf holding territory that potentially will dig dens and birth pups in a given calendar year. Age of breeding can be 2 years and up. A non-breeder is a single wolf not holding territory and likely to travel more widely. Both sets of loss figures show more than half (at least 58%) of red wolf losses are directly or indirectly related to human activity. Preliminary analysis of these data suggests the high proportion of red wolf losses from human factors is additive (and not compensatory) to other mortality sources (D. Murray 2007, unpublished data).

Figure 7. Pie chart showing loss of red wolves in the NEP calculated from 166 red wolves lost (1999 – 2006).

Figure 8. Pie chart showing loss of 99 non-breeding red wolves in the NEP (1999 – 2006). Vehicle strike, gunshot, and disappearance are the leading categories of non-breeder loss.

Figure 9. Pie chart showing loss of 67 breeding red wolves in the NEP (1999 – 2006). Gunshot and disappearance are the leading categories of breeder loss.



During the past five years, pup fostering has developed as a significant and useful population management tool in red wolf recovery (Waddell et al. 2002; Kitchen and Knowlton 2006). Fostering involves placing captive-born pups less than two weeks old into the den of wild red wolf parents. The parents adopt and raise the fostered pups, teaching them valuable survival skills. Twenty red wolf pups were fostered into the NEP in 2002, 2004, 2006 and 2007, including 9 wild born pups. Facilities in the red wolf captive program provided 9 pups, and the Bulls Island (Cape Romain NWR) propagation site provided 2 pups. Fostering offers many options, including augmentation of the wild red wolf gene pool with "under-represented" genes from the captive red wolf population.

See Appendix D for additional new information useful in red wolf NEP management.

2.3.2. Five Factor Analysis

2.3.2.1. Present or threatened destruction, modification or curtailment of habitat or range.

Red wolves declined early in the settlement history of North America, long before scientists could fully study and observe them in unaltered native habitat. It is possible red wolves used higher elevation habitat in hills and mountains of eastern North America, but supporting documentation is scarce. Red wolves may have occurred in extensive bottomland forests and wetlands along rivers of the southeastern United States (Paradiso and Nowak 1971, 1972; Riley and McBride 1972). The few remaining wild red wolves captured during the mid-1900's used prairies and wetlands of coastal Texas and Louisiana (Carley 1975; Shaw 1975); these locations were less altered or less disturbed by human activity, but were possibly marginal for red wolves.

We can infer functional habitat for red wolves from the kinds of habitat used in the North Carolina NEP. Since 1987, red wolves restored in the NEP have used a mosaic of habitat types across 1.7 million acres that include wetlands, pine forests, upland shrubs, crop land, and pocosins. Christensen et al. (1981) described pocosins as wetland forests with pine tree overstory and evergreen shrub understory. Wooded areas seem important for dens and pup rearing, though dens are built in a variety of habitat types (Hinton 2006, Kelly et al. 2004, Phillips et al. 2004). Red wolves in the NEP frequently have used edge interface habitat for ease in travel and access to prey. Hahn (2000) suggested low human density, wetland soil type, and distance from roads may influence habitat suitability for red wolves in the NEP. We also know that large acreage,

rural or wild settings, and the abundance and diversity of prey species are important factors in success of the red wolf NEP. Overall, these observations suggest red wolves are habitat generalists able to live in areas where prey and shelter are sufficient, so long as habitat fragmentation, disturbance or harassment by humans are minimal or do not occur.

To better understand red wolf habitat requirements and examine potential influences by population variables, we work with scientists to develop resource selection functions (RSF's) for red wolves in the North Carolina NEP. We collaborate with scientists involved in similar work on Algonquin wolves (*C. lupus lycaon*; or, eastern wolves, *C. lycaon*) in Algonquin National Park, Ontario, Canada. We will use RSF's developed for wolves in both the North Carolina NEP and Algonquin Park to develop spatial models of wolf habitat requirements in eastern North America. Over the next few years, these spatial models will be applied to regions across the eastern United States to evaluate candidate areas for additional red wolf population releases.

For centuries, fragmentation in red wolf historic range has come in the form of habitat conversion and land development by humans. Proposed development projects on the Albemarle Peninsula will have short-term and long-term effects on red wolves in the NEP unless potential effects are addressed early via planning, designs, and project implementation. We ask managers of large development projects on the Albemarle Peninsula to work with us in incorporating red wolf recovery concerns. Development projects could incorporate such concepts as habitat corridors, habitat linkages, population genetics, prey species, red wolf sociality, movements and dispersal. Efforts to address potential effects of proposed development projects are further discussed in sections 2.3.2.4 and 2.3.2.5 below.

Viable populations of wildlife, such as red wolves and their prey, depend on movement and dispersal to maintain genetic diversity. Barriers to dispersal that fragment habitat (e.g., highways, airports, or large fenced areas) can have long-term effects upon genetic diversity. For restored populations of small size, such as the red wolf NEP, fragmenting barriers can magnify these genetic effects and potentially dampen or reverse population growth to a greater degree.

Riley et al. (2006) found a southern California freeway is a significant barrier to gene flow for western coyotes (*C. latrans*) and bobcats (*Lynx rufus*). Roads or other linear barriers may also cause changes in use of spatial habitat, affecting population stability via region-wide social organization. For gray wolves (*C. lupus*), a Wisconsin highway did not influence wolf movements (Kohn et al. 1999), whereas a fenced freeway in Banff National Park, Alberta, Canada, significantly hindered

movements of wolves and other carnivores (Paquet and Callaghan 1996). Animal overpass structures helped to mitigate barrier effects in Banff National Park (Clevenger and Waltho 2000, 2005). Forman et al. 2003 found that wolves prefer large, open wildlife overpass or underpass structures.

Habitat fragmentation remains one of the biggest challenges in red wolf recovery. Fragmentation contributed to the initial decline of the red wolf species. Now, fragmentation threatens red wolves in the North Carolina NEP via proposed barriers and habitat conversion on both public and private land. Because red wolves are wide-ranging in their movements, conservation of large tracts of wildlife habitat is beneficial across their historic range. This is especially important if we are to eventually restore two additional red wolf populations within their historic range.

2.3.2.2. Overutilization for commercial, recreational, scientific, or educational purposes.

We do not consider over-utilization for commercial, recreational, scientific, or educational purposes to be a direct threat to the species. Red wolves are not legally hunted or trapped, aside from incidental or special permitted events. We are not aware of any deliberate trade in red wolves or in their parts. However, sections 2.3.2.4 and 2.3.2.5 highlight problems related to state licensed or permitted utilization (i.e. wildland hunting, hunt enclosures, trapping) of other species which sometimes results in red wolf injury and mortality.

All red wolves are currently located either in captive breeding facilities, at two island propagation locations, or in one heavily managed and monitored NEP that occurs across the 1.7 million acre Albemarle Peninsula. The captive red wolf population is managed under an AZA (Association of Zoos and Aquariums) species survival plan to conserve the red wolf genome, coordinate captive breeding, provide select red wolves for restoration in the wild, and advance the sciences of cryopreservation and banking of red wolf gametes. Thus, captive red wolves are utilized for conservation, propagation, and selectively for both scientific and educational purposes (USFWS 1990). However, because these activities are focused toward specific recovery and conservation objectives, they are not considered over-utilization for commercial, recreational, scientific, or educational purposes.

2.3.2.3. Disease or predation

Because canid diseases can spread quickly, they can cause serious setbacks in red wolf recovery. Canid diseases remain a serious threat to the red wolf NEP and to captive red wolves. The magnitude of risk to the red wolf species overall is partly offset by captive red wolves held in 40 facilities across America. Risk of disease is also partly offset by intensive vaccination programs for both wild and captive red wolves. However, veterinary research scientists caution we should not presume vaccinated red wolves are adequately protected against diseases. An example is CPV2 parvovirus, a disease which could have serious impacts upon pup survival in the NEP (Action et al. 2007, *in review;* Stoskopf 2007 *in litt.*). Acton and colleagues found that titers against parvovirus are not detectable in a large portion of vaccinated red wolves, indicating the NEP is still very much at risk to CPV2 parvovirus. This is important because poor pup survival from parvovirus caused the Service in 1998 to discontinue the Great Smoky Mountains red wolf NEP (Henry 1998).

Additional precautions are needed to proactively address potential disease outbreaks in the red wolf NEP and captive population. Establishing two more NEPs within red wolf historic range will partly alleviate disease risk. However, we are particularly concerned about import of existing and new strains of canid disease carried into a red wolf NEP by outside sources. Hunting dogs and imported coyotes from elsewhere in America are two outside sources of prime concern. (See section 4 for future recommended actions to be taken to address disease.)

Scientists on the Red Wolf Recovery Implementation Team recommended in 2006 that a red wolf disease prevention and surveillance program be developed to ensure long-term survival in the red wolf NEP. Specifically, a canid disease prevalence program should be developed and implemented in the five counties occupied by the NEP. The diseases of greatest concern are canine distemper (Genus *Morbillivirus; CDV)*, canine parvovirus (Genus *Parvovirus; CPV1, CPV2)*, leptospirosis (Genus *leptospira*), hemobartonellosis (*Haemobartonella canis*), borrelliosis (Lyme disease, *Borrelia sp.*), demodectic mange (*Demodex canis* mites), sarcoptic mange (*Sarcoptes scabiei* mites), heart worm (*Dirofilaria immitis*), and rabies (Genus *Lyssavirus, rabies virus*). We are fortunate that none of these diseases to date have occurred at sufficiently high levels to cause an epidemic in the current NEP. However, sarcoptic mange contributed to the deaths of 14 red wolves in the NEP since 1999.

Numerous diseases and other ailments have been documented during the past thirty years in individual red wolves. During 2007, we observed eye entropia in three young captive program red wolves being held at Alligator River NWR. Other physical anomalies were observed in captive red

wolves in recent years, such as progressive retinal atrophy, malocclusion and undescended testicles (Waddell, Pers. Comm. 2007). Heartworms, hookworms (*Ancylostoma caninum*), and sarcoptic mange, are serious concerns, but heartworms and hookworms have so far not been identified as a significant source of mortality in the NEP (USFWS 1990; Phillips and Scheck 1991). Tick paralysis was reported by Beyer and Grossman (1997), while Rothschild et al. (2001) reported arthritis, and Harrenstein et al. (1997) reported antibody responses to canine distemper and canine parvovirus indicating prior exposure. Penrose et al. (2000) reported the lyme disease causing bacteria *Borrelia burgdoferi* in a red wolf. Neiffer et al. (1999) reported abdominal disease involving cecal inversion and colocolic intussusception. Kearns et al. (2000) reported dermatosis.

Acton et al. (2000) surveyed necropsy results in 62 captive program red wolves for the period of 1992 to 1996. They documented numerous ailments in individual red wolves of many different ages. Of 22 neonatal deaths, major causes included parental trauma, parasitic pneumonia, and septicemia (systemic bacteria often found in the blood). Two juvenile red wolves died of cardiovascular anomalies or systemic parasitism. Of 38 adult red wolf deaths, causes included neoplasia and gastrointestinal diseases. Of the fatal neoplasm conditions, 50% were lymphosarcoma.

Natural predation on red wolves is minimal, especially since red wolves are top predators in their ecosystem. Though uncommon, red wolves are most vulnerable as small pups exposed to threats of predation by black bears (*Ursus americanus*), bobcats (*Lynx rufus*), coyotes (*C. latrans var.*), alligators (*Alligator mississippiensis*),), eagles (*Haliaeetus leucocephalus* or *Aquila chysaetos*), hawks (*Buteo spp.*), or owls (*Bubo virginianus* or *Strix varia*).

2.3.2.4. Inadequacy of existing regulatory mechanisms

a. Designation and Restoration of Experimental Populations

Under section 10(j) of the Endangered Species Act of 1973 (Act), as amended (U.S.C. 16 section 1531 et seq.), the Secretary of the Department of the Interior may designate restored populations established outside the species' current range, but within its historical range, as "experimental." Based on the best scientific and commercial data available, we must determine whether experimental populations are "essential" or "nonessential" to the continued existence of the species. Regulatory restrictions are considerably reduced under a NEP designation.

Without the NEP designation, the Act provides that species listed as endangered or threatened are afforded protection primarily through the prohibitions of section 9 and the requirements of section 7. Section 9 of

the Act prohibits the take of an endangered species. "Take" is defined by the Act as "harass, harm, pursue, hunt, shoot, wound, trap, capture, or collect, or attempt to engage in any such conduct." Service regulations (50 CFR 17.31) generally extend the prohibitions of take to threatened wildlife. Section 7 of the Act outlines the procedures for Federal interagency cooperation to conserve federally listed species and protect designated critical habitat. It mandates that all Federal agencies use their existing authorities to further the purposes of the Act by carrying out programs for the conservation of listed species. It also states that Federal agencies will, in consultation with the Service, ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Section 7 of the Act does not affect activities undertaken on private land unless they are authorized, funded, or carried out by a Federal agency.

A population designated as experimental is treated for the purposes of section 9 of the Act as threatened, regardless of the species' designation elsewhere in its range. Threatened designation allows us greater discretion in devising management programs and special regulation for such a population. Section 4(d) of the Act allows us to adopt whatever regulations are necessary to provide for the conservation of a threatened species. In these situations, the regulations that generally extend most section 9 prohibitions to threatened species do not apply to NEPs, although the special 4(d) rule contains the prohibitions and exceptions necessary and appropriate to conserve that species. Regulations issued under section 4(d) for NEPs are usually more compatible with routine human activities in the NEP area.

For the purposes of section 7 of the Act, we treat a NEP as a threatened species when the NEP is located within a National Wildlife Refuge or National Park, and section 7(a)(1) and the consultation requirements of section 7(a)(2) of the Act apply. When NEPs are located outside a National Wildlife Refuge or National Park, we treat the population as proposed for listing and only two provisions of section 7 apply: section 7(a)(1) and section 7(a)(4). In these instances, NEPs provide additional flexibility because Federal agencies are not required to consult with us under section 7(a)(2). Section 7(a)(4) requires Federal agencies to confer (rather than consult) with the Service on actions that are likely to jeopardize the continued existence of a species proposed to be listed. The results of a conference are advisory in nature and do not restrict agencies from authorizing, funding, or carrying out activities.

b. NEP Status for Red Wolves on the Albemarle Peninsula

The current location of the red wolf NEP within historic range is the Albemarle Peninsula of northeastern North Carolina. The Peninsula is composed of five counties (Beaufort, Dare, Hyde, Tyrrell, Washington) and contains four National Wildlife Refuges (Alligator River NWR, Pocosin Lakes NWR, Mattamuskeet NWR, Swan Quarter NWR). The red wolf NEP began with the release of four pairs of wolves on the Alligator River NWR. The red wolf is otherwise believed to be extirpated from the wild, implying there are no other extant populations with which this NEP could come into contact (51 FR 41797; 58 FR 52031).

As described above, NEP status for red wolves on the Albemarle Peninsula means reduced protections for red wolves under the Act. However, NEP status is a helpful mechanism which allows us to work cooperatively with partners to enhance red wolf recovery and resolve problems. NEP status also allows flexibility for landowners, land managers, communities and other citizens (Parker and Phillips 1991). For example, the Federal rules (51 FR 41797 and 50 CFR 17.84) that contain necessary prohibitions and exceptions allow for take of red wolves which constitute a demonstrable threat to human safety or livestock, provided it has not been possible to eliminate such threat by live capture and relocation of the wolf.

On the Albemarle Peninsula, proponents should both consult formally under section 7(a)(2) and confer under section 7(a)(4) of the Act in cases when projects or activities with a Federal nexus have potential adverse effects to red wolves on NWR land and could jeopardize red wolves off NWR land. In these cases, formal consultation is required to address potential effects to red wolves on NWR land, while conferencing is done to address potential effects to red wolves not on NWR land. These cases result in the Service recommending consideration of the red wolf NEP as a whole in both biological assessment and biological opinion documents. Relevant project and effects information is written into a biological assessment to initiate formal consultation under section 7(a)(2).

We encourage partners and project proponents to weigh potential biological effects on red wolves across the entire NEP in overall support of our effort to recover red wolves, even though as stated above, the results of a conference report are advisory in nature. For example, proposed expansion of U.S. Highway 64 from Columbia to Manns Harbor could mean impacts of habitat fragmentation, barriers to red wolf gene flow, and increases in red wolf mortality from vehicle strikes. Considering the level of protection red wolves receive both on and off NWR land, we need partners like the Federal Highway Administration and the North Carolina Department of Transportation to assist us in addressing

the recovery needs of the red wolf NEP during highway expansions. In another example, we are working with the U.S. Navy under sections 7(a)(2) and 7(a)(4) of the Act toward resolving potential adverse impacts upon red wolves from a proposed outlying landing field. The project involves extensive fencing, habitat conversion and development proximal to the Pocosin Lakes NWR. We are also concerned about noise disruption, red wolf prey, coyote management, and potential loss of red wolves via territory disruption that leads to intra-specific strife and subsequent dispersal. We need partners like the U.S. Navy to assist us in addressing the recovery needs of the red wolf NEP during the planning of proposed military projects.

c. State Status

The red wolf remains federally listed as endangered throughout its historic range in the southeast USA west to central Texas. However, the red wolf was recognized as extinct in the wild in 1980 (see appendix B), and the last known remaining red wolves were brought into captivity. Therefore, red wolves in captivity are endangered and wolves in NC are designated as a NEP. New information suggests red wolf historic range extends farther north than previously believed (section 2.3.1.a).

Five states actively post the red wolf on their state status lists of threatened or endangered species. The red wolf has state endangered status in Texas, Louisiana, Missouri, and Florida, with state special concern status in Georgia. In North Carolina, a state non-game advisory committee is evaluating whether or not the red wolf should have special concern status at the state level. Special concern status would acknowledge the red wolf as a species in need of monitoring which occurred historically in North Carolina. Special concern status would encourage new partnerships with the North Carolina Wildlife Resources Commission (NCWRC) to address management of red wolves.

Except for the five states listed above which actively post state status for red wolves, we are aware of no other laws, regulations, policies, or programs which afford red wolves protection, conservation or recovery outside of the Act. We are also not aware of any regulatory mechanisms for red wolves or their habitat afforded at the city or county levels. Therefore, the primary mechanisms currently available to achieve red wolf recovery are voluntary partnerships, community stewardship, project planning and design, federal, state, and other agency cooperation, protections of the Act on NWR's and in National Parks, and limited protections of the Act on land not in NWRs nor in Parks.

d. Conclusions About Regulatory Mechanisms

We conclude that NEP status is effective in red wolf conservation and in allowing flexibility for red wolves and people. Such flexibility allows less regulation while addressing needs in human safety and property. However, we also believe we must give consideration to making improvements in the current experimental rule (50 CFR 17.84) in cooperation with the State to address additional issues related to wolf mortality, law enforcement, coyote management, clarifications, and additional flexibility for people.

2.3.2.5. Other natural or manmade factors

We consider other natural and manmade factors described below to be among the most serious current threats to red wolves. Together with the threats described above, we are concerned cumulative effects may cause the current red wolf NEP status to remain stationary or otherwise decline. These concerns can be resolved if human factors become ameliorated via partnerships, outreach and education

a. Gunshot Mortality

Gunshot mortality is a serious threat to red wolves in the North Carolina NEP. Preliminary figures generated in 2006 and 2007 (D. Murray unpublished data) showed that a wild red wolf is 7.2 times more likely to be killed by gunshot during the hunting season than during the non-hunting season. The number of red wolves shot during the 79 day annual hunting season exceeds the number of red wolves shot during the remaining 286 days of the year, and this applies to every year except 1997 and 1998 when fewer wolves were lost to gunshot. Per day, red wolves were 1.7 times more likely to disappear during the hunting season. Significantly fewer red wolves whose signal were lost during the hunting season were recovered (29.4%) compared to red wolves with lost signals during the rest of the year (52.1%).

Whether accidental by licensed hunters, or illegal, gunshot mortality since 2004 is hampering the ability of the red wolf NEP to continue its upward trend in growth. Since 2004, gunshot mortality has reduced the number of breeding pairs and pups in the NEP and otherwise removed growth potential (Figures 10 and 11). Declines from gunshot show as dips in counts that occur in Figures 1, 2 and 4 from 2004 to 2007, even though the overall population trend from 1987 to 2007 remained upward. When gunshot reduces the existing or potential number of wolves, the NEP suffers reduced ability to hold and defend territories against coyotes, sometimes allowing interbreeding. We believe gunshot mortality must be

addressed to in order to main the upward growth trend of the red wolf NEP.

We used data collected since 1999 to calculate mortality, replacement and litters related to incidents of gunshot and disappearance. From 166 known mortalities for all red wolves since 1999, our data show 22% (n=39) killed by gunshot and another 22% (n=38) which disappeared (Figure 7). Of 67 known mortalities for breeding red wolves only, our data show 32% (n=21) killed by gunshot and another 26% (n=17) which disappeared (Figure 9). From April 2006 to April 2007 alone, we lost a total of eight breeder red wolves to gunshot (Figure 10), with two to five red wolves lost in prior years back to April of 1999. Thus, gunshot mortality contributed in part to a reduction in the number of red wolf breeding pairs from 22 in 2003 to only 15 in 2005 and 2006, rebounding to 20 in 2007 (Figure 4) largely because of hard work by red wolf field biologists to create additional red wolf breeding pairs. Our data (Figure 11) further show that loss of 27 breeders in specific territories since 1999 to gunshot and suspected gunshot resulted directly in 23 cases of no wolf litters and 4 cases of hybrid litters. The loss of 27 breeders (Figure 11) also resulted in only 7 lost breeders replaced in territories by other adult wolves, with 10 lost breeders replaced by 10 non-wolves (coyote or hybrid), and with 10 lost breeders not replaced at all. We conclude that gunshot mortality on the breeding segment of the red wolf NEP is disproportionately high, implying that the population consequences of such mortality is highly limiting to red wolf NEP population growth.

Figure 10. Loss of NEP red wolf breeders to gunshot and suspected gunshot since 1999.

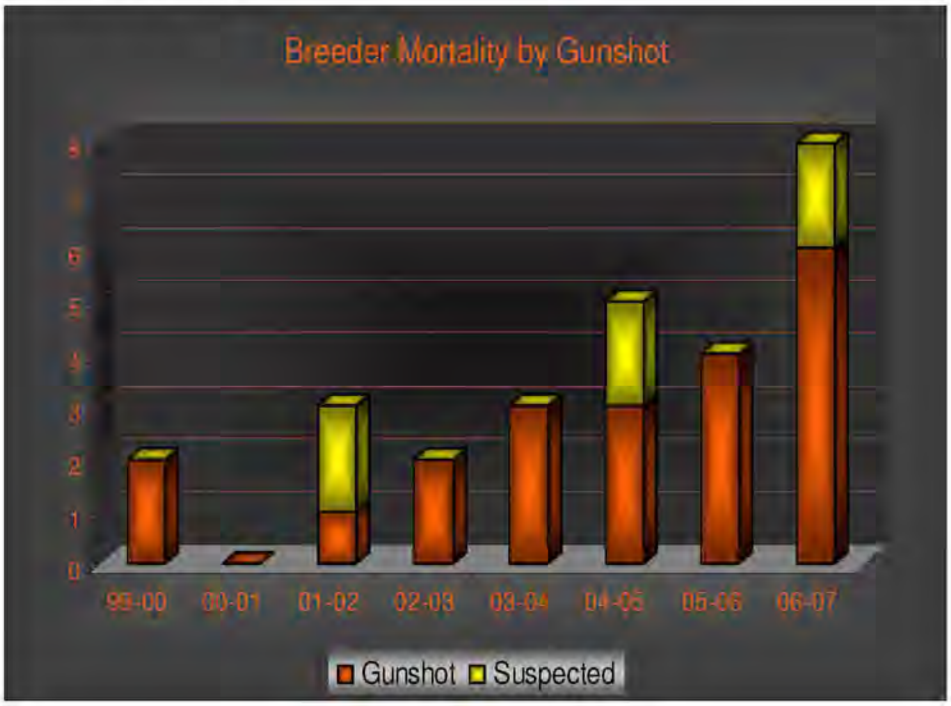
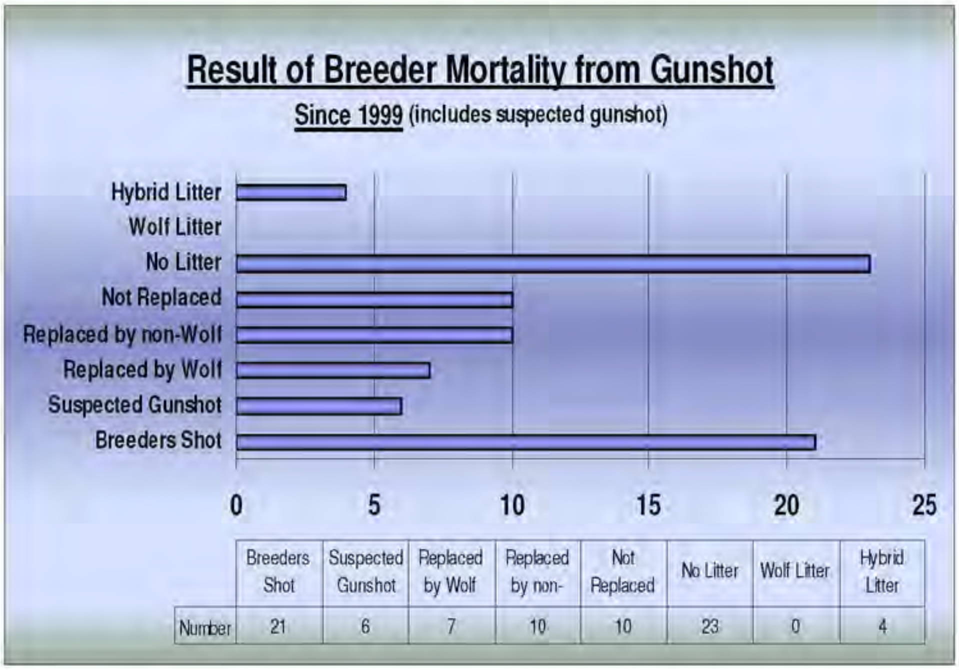


Figure 11. "Replacement result" from loss of NEP red wolf breeders from known or suspected gunshot. Of 27 breeders lost, 23 resulted in no wolf litters, four resulted in hybrid litters, and only seven were replaced in territories by other wolves. Ten were replaced by non-wolves (coyote or hybrid), while ten others were not replaced.



b. Mortality From Vehicle Strikes

Trombulak and Frissell (2000) showed roads can result in mortality events in large carnivores from causes that are direct (e.g., vehicle strikes) and indirect (e.g., behavior changes affecting food acquisition). Vehicle strike mortality significantly impacts the red wolf NEP in North Carolina. Of 166 known adult red wolf loses since 1999, vehicle strikes are three times higher in non-breeder (19%) vs. breeder (6%) red wolves of the NEP (Figures 8 and 9). This is partly explained by single red wolves dispersing or roaming over large distances. From 270 known red wolf mortalities recorded for the NEP between 1987 and 2006, vehicle mortality was calculated to be 17.4 percent (D. Murray 2007, unpublished data).

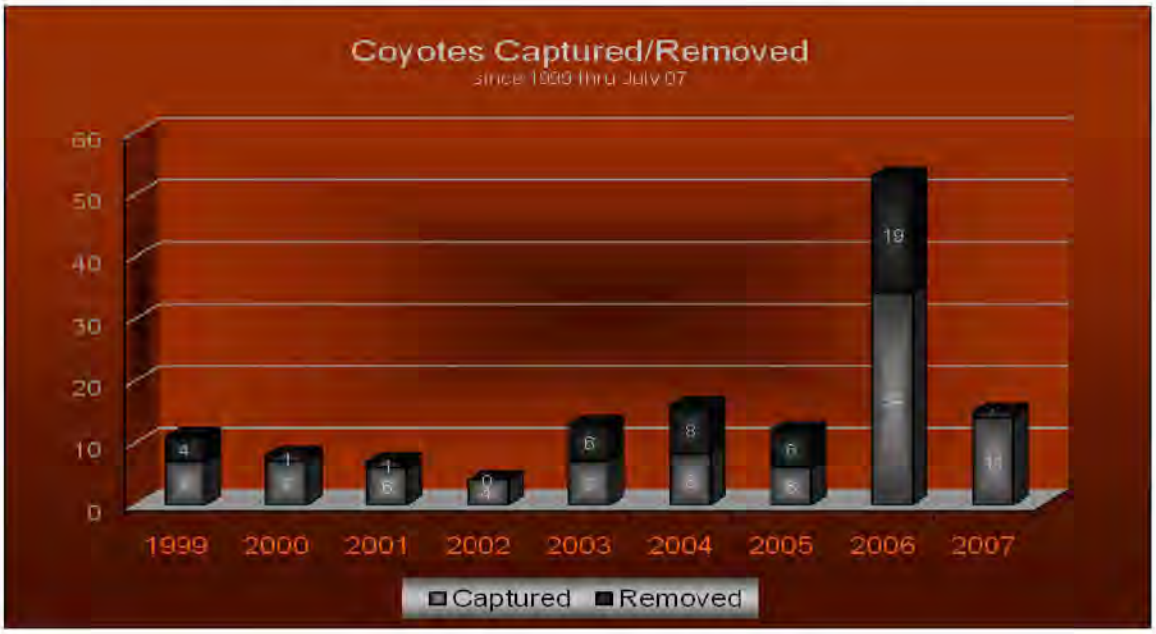
c. Eastern Coyotes

Eastern coyotes, sometimes called brush wolves, continue to be a serious threat to the red wolf across its historic range. In North Carolina, we have made good progress in managing eastern coyotes and their gene introgression threat. Implementation of our adaptive management plan (Kelly 2000; Fazio et al. 2005) since the year 2000 has led to good progress in reducing introgression of coyote genes and reducing the number of coyotes in the red wolf NEP area (Adams 2006, Beck 2005, Stoskopf et al. 2005.)

Our adaptive management and monitoring efforts prior to 2006 effectively reduced the number of coyotes on the Albemarle Peninsula where the red wolf NEP occurs. Yet, an unusually large increase in eastern coyotes was detected in 2006 and 2007 on the Peninsula (Figure 12). This is partly explained by gunshot mortality of red wolves creating open territories which invite eastern coyotes. This is also partly explained by accidental release of eastern coyotes from hunting enclosures ("fox pens") used to hunt imported coyotes. However, based on first-hand accounts, deliberate release of eastern coyotes by a small number of people explains much of the increase in coyotes observed. From 1999 through 2005, an average number of six eastern coyotes were captured each year by red wolf field biologists and cooperating local trappers on the Peninsula (Figure 12). During 2006, a total of 34 coyotes were captured, with an additional 14 coyotes captured during the first 6 months of 2007 (Figure 12). (Note that increases in both our trapping effort and the size of the area trapped could also account for some of the increase in coyotes captured.)

Recognizing the NCWRC has lead authority in management of furbearers such as coyotes and foxes, we would like to work collaboratively with the NCWRC on statewide approaches to manage canids and address mutual issues of concern. We encourage approaches which include trappers and animal damage control specialists as part of the solution in reducing state-wide coyote numbers. We suggest addressing the import, health and containment of coyotes used for hunting in enclosures (locally called, "fox pens"). We also suggest uniform standards for construction and maintenance of fox pens to prevent coyote escapes. New safeguards which prevent red wolves from being trapped and hunted in fox pens will be helpful. We also hope approaches will address the unauthorized import and release of eastern coyotes directly into the wild by people. The problem of people shooting what they believe to be a coyote on the Albemarle Peninsula, only to learn they shot and killed a red wolf, is another serious issue we hope will be addressed. Statewide precautions in canid disease management can be designed to fit with the Albemarle Peninsula NEP disease prevention and management plan described in section 2.3.2.3 above.

Figure 12. Numbers of eastern coyotes captured from 1999 to 2007 in the red wolf experimental population area located on the Albemarle Peninsula in North Carolina. Figures for 2007 are for the first six months only. Captured coyotes are sterilized and returned to a territory to hold space until replaced by red wolves over time. If a there is no space available for a sterilized coyote, we euthanize at the request of the landowner.



We conclude management of eastern coyotes on the Albemarle Peninsula continues to be necessary to further reduce the threat of coyote gene introgression into the red wolf NEP. Interaction studies between red wolves and coyotes will be helpful to determine dynamics necessary for long-term management. Partnerships and education are important to help people understand the problems eastern coyotes cause. Involvement of local communities and other stakeholders will be helpful in curbing the deliberate release of eastern coyotes.

d. Hurricanes/Tropical Storms and Global Climate Change

Natural weather events and global climate change will play growing roles in long-term survival and recovery of red wolves. The red wolf NEP in North Carolina is subject to annual tropical storm activity. In fact, Hurricane Isabel resulted in the deaths of two captive red wolves during September of 2003, with no noticeable long-term impacts observed in the NEP. However, the NEP and associated prey species remain vulnerable to sea level rise and flooding related to climate change and hurricanes. Additional long-term changes in habitat availability, prey abundance, and other ecological or landscape factors will occur with climate change (Parry et al. 2007). Thus, long-term assessment and planning are needed that consider the current NEP and future populations in the context of tropical storm activity, global climate change, and resulting changes in the North American landscape over time.

2.4. Synthesis

Considering the grave challenges red wolves faced when first listed as endangered in 1967, efforts to restore, recover and conserve them have been remarkably successful. Red wolves have been transformed from nearly extinct at a count of only 14 individuals in the 1970's to a captive population of 208 and a restored wild NEP with counts up to nearly 130. The red wolf was pulled back from the brink of extinction and given a fighting chance for survival. We conclude that NEP status is effective in red wolf conservation and in allowing flexibility for red wolves and people. The red wolf faces many more challenges, but its journey in science and wildlife management to date has been extraordinary with assistance from many partners and scientists who truly make a difference. We thank all those who have worked so hard in red wolf recovery since the 1960's. We particularly thank the landowners who work with us regularly to conserve red wolves in a balance that also conserves their own rural heritage and lifestyle.

Data presented above and in noted published papers show the red wolf adaptive management work plan is effective at reducing coyote gene introgression while restoring the wild red wolf NEP. Field data shows red wolves are beginning to challenge non-wolves for territorial space. Data collected over 20 years shows trends of increase in size of the wild red wolf NEP. New, preliminary data suggests the red wolf NEP may be reaching carrying capacity, but closer examination of data is needed to verify if this is true.

The wild red wolf NEP today experiences a series of threats that originally caused the red wolf to decline across its historic range starting with early settlement of North America. Early persecution and habitat fragmentation originally reduced red wolves to the point of human-induced near-extinction and interbreeding with coyotes. Today, gunshot mortality removes breeders from the wild NEP and,

along with habitat fragmentation from mounting development, invites eastern coyotes to enter the NEP area. Releases of coyotes and canid disease outbreaks are additional threats we must work to reduce. Interruption of gene flow by barriers and habitat alterations are a new concern we must manage.

Future success in red wolf recovery will depend heavily upon the assistance and actions of partners that include local communities and state wildlife agencies like the NCWRC. Mortality and loss in the NEP related to human activity represent more than half of all losses. So, mortality and loss from gunshot, vehicle strikes and disappearance are factors we must reduce via education, community participation, law enforcement, and planning. Our objective of 330 wolves in captivity will only be met with the help of our very capable species survival plan partners that include the AZA. Our other objective of two additional wild red wolf populations within historic range will be more easily achieved with state participation and local support.

The Red Wolf Recovery Program is one of the oldest recovery programs for an endangered species in the USA. Significant amounts of red wolf recovery have been achieved, and we believe significantly more success is possible. The red wolf remains one of North America's most critically imperiled vertebrates (NatureServe 2007) and one of the world's most critically endangered canids (IUCN 2006). We look forward to working with our partners at all levels to reach new milestones in science, cooperation, and conservation to achieve new levels in red wolf recovery.

3. RESULTS

3.1. Recommended Classification

__X__ No change is needed

3.2. Recovery Priority Number

The red wolf's Recovery Priority Number should remain at 5C.

4. RECOMMENDATIONS FOR FUTURE ACTIONS

At this time, two contributions can result in immediate gains in red wolf recovery. One immediate contribution involves actions which result in significant reduction of the portion of red wolf mortality attributed indirectly or directly to humans. Another immediate contribution involves concurrent work to assist in the development of a cooperative statewide canid management plan or policy with NCWRC and U.S. Department of Agriculture Wildlife Services officials. Three

additional contributions can result in long-term species stability. These long-term contributions involve expanding the captive red wolf population, establishing additional wild red wolf populations, and developing effective disease prevention and management plans. Overall, we recommend the following actions be implemented during the next five years.

a. Develop an effective disease prevention and management plan for red wolves and other canid species in northeastern North Carolina.

b. Expand the number of facilities participating in the Red Wolf Species Survival Plan to continue to meet genetic diversity objectives and to aid in establishing any future additional red wolf populations. Support Tacoma Metroparks and the Point Defiance Zoo and Aquarium in Washington with relocation and reconstruction of the flagship red wolf captive breeding facility located there. Enhance partnerships in the Red Wolf Species Survival Plan with staff at facilities across North America to enhance red wolf captive breeding.

c. Identify and evaluate land areas in red wolf historic range that could be considered for potential establishment of second and third wild red wolf populations. Examine biological and human factors important in identifying new restoration locations. Evaluate site selection concepts offered by states, scientists, and partners (Knowlton 2007 *in litt*.; Kyle et al. 2007; Van Manen et al. 2000; Defenders of Wildlife 2005 *in litt*.; Scott et al. 2005; Stoskopf 2007 *in litt*.; Murray 2007 *in litt*.; among others). Biologists have known since the first wolf was released in North Carolina and based on the recovery plan for the red wolf, that the species cannot be recovered by restoring it only to the Albemarle Peninsula. Before release of red wolves in North Carolina, the Service recognized the impacts this action would have and cooperated extensively with the State and local communities in order to be able to initiate an important recovery action while maintaining flexibility to ensure human safety and activities would be considered. One of the objectives to attain the red wolf's recovery is to restore and expand the red wolf into other suitable habitats within its historic range. The Service's immediate focus is on its recovery efforts for the red wolf NEP. The Service would like to explore the feasibility of restoration of other populations and intends to work in cooperation with States, partners, and local communities.

d. Work collaboratively with the U.S. Department of Agriculture Wildlife Services in support of efforts by the NCWRC to develop a cooperative statewide canid management plan or policy. With NCWRC leadership, develop a plan or policy concurrent with developing new state and federal regulations which address the most pressing canid issues in the State of North Carolina. Include the issues of landowner needs, hunter stewardship, trapping opportunities, wolf management areas, and canid disease management. Focus on the illegal import, illegal release, and fox pen hunting of invasive eastern

coyotes, with safeguards ensuring wolves are not hunted in fox pens. Focus on elimination of eastern coyotes from the Albemarle Peninsula to the extent feasible. Include in the cooperative plan provisions to effectively manage wolves, coyotes, wolf-dog hybrids, foxes and exotic variations of these animals.

e. Develop cooperative actions which result in significant reduction of the portion of red wolf mortality attributed indirectly or directly to people. Work with the North Carolina Wildlife Resources Commission and the North Carolina Department of Transportation to develop cooperative measures which reduce the loss of red wolves caused by gunshot and vehicles strikes. Develop and implement educational outreach measures to highlight to people and local communities we need their assistance in reducing red wolf mortality. Encourage managers of large development projects and partners on the Peninsula to work with us in incorporating red wolf recovery concerns. Develop mutually beneficial landowner incentive measures. Explore potential joint state and federal law enforcement measures.

f. Draft a new recovery plan and species survival plan for the red wolf. These plans should incorporate significant advances in science and information developed since approval of the 1990 Red Wolf Recovery/Species Survival Plan. The 1982, 1984 and 1990 plans were written to identify measures which ensure immediate survival of red wolves in captivity and in the red wolf NEP. Many tasks in these early plans associated with captive rearing and restoration into the wild are completed or ongoing with significant gains in survival pulling the red wolf away from the brink of extinction. After 20 years of restoration and management of red wolves in the wild and in captivity, we must set new recovery goals, objectives, criteria, tasks and research needs. These should focus on population management, restoration in historic range, expanded captive breeding, reduction of new threats, long-term conservation, delisting, and down-listing.

g. Establish a human dimensions sub-team and a community stakeholder group to advise the Service and Red Wolf Recovery Implementation Team scientists on human factors and issues important in successful red wolf recovery.

h. Maintain at least two locations which fulfill the vital restoration roles of island propagation sites that contribute directly to both wild red wolf population(s) and captive breeding. The two sites currently with such capabilities are St. Vincent NWR in Florida and Cape Romain NWR in South Carolina.

i. Launch studies of wolf/coyote interaction and monitoring to identify additional long-term strategies for wolf and coyote management, with focus on the western end of the red wolf NEP.

j. Consider updating the red wolf 4(d) rule in cooperation with the State to reflect additional strength and flexibility needed for landowners, land managers, hunters, trappers, communities, red wolves and law enforcement officers. Another option is to identify alternate conservation incentive agreements with land owners and land managers.

k. Engage further science in the discussion of relationships between red wolves and Algonquin wolves and whether or not they should be managed together across a broader geographic continuum.

l. Launch enhanced, expanded and new efforts to educate local communities and visitors about red wolf conservation and ecosystem values. Share red wolf conservation values with children, families, other stakeholders and the general public. Enhance partnerships developing ecotourism values for local communities proximal to the wild red wolf population(s). Assist partners in their efforts to promote ecotourism and establish an education center emphasizing red wolf, refuge, farming, hunting and other natural resource community values.

m. Evaluate how the effects of climate change will influence red wolf recovery. Develop plans which address the effects of climate change via strategies in long-term conservation.

n. Continue to implement and further develop the red wolf adaptive management plan for wild red wolf population(s), based on regular evaluations and recommendations by scientists from the Red Wolf Recovery Implementation Team.

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APPENDICES

Appendix A – Peer Review Process and Highlights of Comments

1. Summary of Results of Peer Review Process

Public Comments: The Service received public comments from two non-profit organizations. Defenders of Wildlife sent a six page letter dated November 21, 2005. The Red Wolf Coalition provided oral comments reflecting Defenders' comments before close of the 2005 public comment period. The concerns and recommendations expressed by Defenders and the Coalition are addressed in the threats and synthesis sections of the document. Members of Defenders are greatly concerned about anthropogenic mortality (e.g., gunshot, vehicle, etc.) and lack of state protections for red wolves. They are also concerned about cumulative impacts from habitat fragmentation and development pressures across the Albemarle Peninsula. They ask that our adaptive management and restoration efforts continue, and they encourage us to move forward in identifying new locations for establishing red wolf wild populations.

Scientific and Technical Peer Reviewer Comments: The red wolf five year review document underwent scientific and technical peer review at the four levels shown below.

Comments from Review Level 3 scientists highlighted the possibility that the wild red wolf population on the Albemarle Peninsula in North Carolina may have reached its functional carrying capacity. These scientists note that remaining unoccupied habitat may be of low quality and limiting to the red wolf wild population. Some of these scientists also express serious concern about vulnerability of red wolves in the NEP to disease. Comments, reasoning and data submitted by these scientists are incorporated into the biological updates section and habitat threats section of this document.

Highlights of comments from Review Level 4 scientists are as follows.

1) Comment: General need exists for the Service and the NCWRC to work more closely together on canid management and related issues, especially in eastern North Carolina. Response: We encourage improvements in partnership between the Service and our state partners, including NCWRC.

2) Comment: Data on sex and age structure in both the red wolf NEP and the captive breeding population should be included in this document. Response: We intend to present red wolf NEP sex and age information in the broader framework of a demographics paper to be published within the next year.

3) Comment: The finite rate of population increase (lambda) is a useful and more commonly reported measure in science that would be useful in analysis of red wolf NEP growth; data provided in the review indicated lambda may be very high for the red wolf NEP. Response: Growth in the red wolf NEP has generally been

upward. We will present estimates of lambda in demographic and modeling papers published within the next year or two.

4) Comment: It will be helpful to relate functional carrying capacity to both biological carrying capacity and cultural carrying capacity. Response: These are important questions currently under our consideration. We will examine these in more detail with greater peer review as we undergo a more rigorous analysis of carrying capacity in the red wolf NEP in the coming months.

5) Comment: With respect to red wolf habits and habitat fragmentation, is data available about prey species utilized by red wolves? If so, it would be helpful. Response: There are two reports on red wolf food habits which examined remains of prey in red wolf scat. Primarily five species of prey were documented, where the proportion of prey species eaten varied with availability in a given territory. Data from NCWRC indicates the deer population in the area of the red wolf NEP remains healthy. These data are published elsewhere, and so far have not been related to potential impacts from proposed development projects.

6) Comment: More thorough analysis of mortality data and other information is needed before concluding that all anthropogenic mortality is additive. Response: We agree our conclusion about additive anthropogenic mortality is based on preliminary data analysis. We also agree more rigorous analysis is necessary.

7) Comment: In Figure 11, why were 10 of 27 breeders not replaced? Response: We do not yet know the answer, but we are concerned other red wolves did not fill in a territory once made vacant via gunshot. More study is needed to find the answers, including whether or not there is a lack of potential breeders in the red wolf NEP.

8) Comment: Suggest a closer look at the coyote influx that occurred in 2006 and 2007; for example, compare ages of coyotes captured in the last two years vs. prior years. Response: We agree a closer look is needed. Comparisons of age, DNA and other parameters may be helpful in understanding the recent influx and where those coyotes came from. We know from first hand accounts that at least a few people are actively releasing coyotes into the wild for purposes of sport, though illegal.

9) Comment: Further comparison studies should take place to more closely examine genetic relationships between red wolves and Algonquin wolves and New England canids. Response: We agree, and some researchers are working on these comparisons now. We encourage more scientific study to more fully explain relationships between these wolves and other New England canids.

10) Comment: Whole skeletons of red wolves (not just skulls) should be saved to allow analysis of morphological features and potential inbreeding effects. Two potential inbreeding conditions to watch for are enamel hypoplasia (slightly

purple tinge in tooth enamel) and vertebrae problems (extra, or asymmetry). Response: We appreciate the advice and will consider saving whole specimens. So far we have not documented the two conditions described, but we will look for these conditions from this point forward.

11) Comment: Management actions appear to be a significant source of mortality. There needs to be a thorough analysis and discussion of this mortality and its nature and rationale. Response: We agree, and we are currently re-evaluating why that portion of mortality over time appears high. Preliminary analysis shows the majority of management mortality is accounted for by trapping incidents (e.g., drowning, injury, etc.) and by changes in genetics identification methods earlier in the program. We used 8 known gene loci to identify canids earlier in the program, whereas we used 19 loci to identify canids later. This change in known loci informed us some canids formerly identified as hybrids were unfortunately wolves euthanized before newer ID methods became available.

We thank all reviewers of this document for their thoughtful responses. The names of reviewers are described below.

Level 1 – Review & Data by Red Wolf Staff (Biologists, Captive Program, Outreach)

Chris Lucash (Wildlife Biologist), Michael L. Morse (Wildlife Biologist), Art Beyer (Wildlife Biologist), Ford Mauney (Wildlife Biologist), Leslie Schutte (Wildlife Biologist), Scott McLellen (Biological Technician), and Ryan Nordsven (Biological Technician), and Diane Hendry (Outreach Specialist).

Will Waddell, Coordinator, Red Wolf Species Survival Plan / Captive Breeding Program, Point Defiance Zoo and Aquarium (PDZA), Tacoma, WA.

Level 2 – Review by Managers/Biologists at USFWS Refuge and Ecological Services Offices

Alligator River National Wildlife Refuge, NC
Pocosin Lakes National Wildlife Refuge, NC
Mattamuskeet National Wildlife Refuge, NC
St. Vincent National Wildlife Refuge, FL
Cape Romain National Wildlife Refuge, SC
Ecological Services Field Office, Raleigh, NC

Level 3 – Review by scientists on the Red Wolf Recovery Implementation Team

Michael K. Stoskopf, DVM, Environmental Medicine Consortium, School of Veterinary Medicine, North Carolina State University, Raleigh, NC

Karen B. Beck, Ph.D, DVM, Environmental Medicine Consortium, School of Veterinary Medicine, North Carolina State University, Raleigh, NC

Lisette Waits, Ph.D / Wildlife Genetics, Dept. of Fish and Wildlife Resources, University of Idaho, Moscow, ID

Dennis L Murray, Ph.D / Population Dynamics, Canada Research Chair in Terrestrial Ecology, Dept. of Biology, Trent University, Peterborough, Ontario, Canada

Todd K. Fuller, Ph.D / Mammalian Ecology, Dept. of Natural Resources Conservation, University of Massachusetts, Amherst, MA

Eric M. Gese, Ph.D / Predator Ecology, Behavior and Depradation, Research Wildlife Biologist, National Wildlife Research Center, USDA Wildlife Services, Utah State University, Logan, UT

Frederick F. Knowlton, Ph.D / Predator Ecology and Control, Research Wildlife Biologist, National Wildlife Research Center, USDA Wildlife Services, Utah State University, Logan, UT

Will Waddell, Coordinator, Red Wolf Species Survival Plan / Captive Breeding Program / Reproduction Research, Point Defiance Zoo and Aquarium (PDZA), Tacoma, WA.

Level 4 – Independent Peer Reviewers

Tim Langer, Ph.D, Bear Biologist, Appointed Commissioner, North Carolina Wildlife Resources Commission, Raleigh, NC

Rolf O. Peterson, Ph.D, Wolf Ecology and Behavior / Mammalian Ecology, School of Forest Resources and Environmental Science, Michigan Technological University, Houghton, MI

Michael R. Vaughan, Ph.D, Large Animal Population Dynamics and Ecology / Bear Research; Professor of Wildlife Science, Dept. of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University (i.e. Virginia Tech); Cooperative Wildlife Research Unit, USGS-BRD, Blacksburg, VA.

Appendix B – Red Wolf Conservation History Prior to 2000

After three centuries of decline from extermination and habitat alteration, the red wolf was thought functionally extinct in the wild by approximately 1980 (Carley 1975; McCarley 1962; McCarley and Carley 1979; USFWS 1984, 1993). The last remaining 17 red wolves were held in captivity for breeding and release purposes (USFWS 1990). Restoration efforts since 1987 established one wild population of red wolves on the Albemarle Peninsula of northeastern North Carolina (Phillips 1994).

During the 1960s, biologists realized that red wolves were well on their way to extinction. Biologists sought legal protection for red wolves by listing the species under the 1966 and 1973 versions of the U.S. Endangered Species Act, as amended (U.S.C. 16 section 1531 et seq.). During the 1970s, biologists determined that only 17 red wolves remained after extensive searches and trapping efforts in southwest, coastal Louisiana and the central, southeastern and coastal portions of Texas. Of the 17 red wolves identified, all were taken into captivity, and 14 were selected to begin a captive breeding population that still exists today. Over the next 20 years, eastern coyotes (*C. latrans var.*) continued to develop, move eastward, and create management challenges across the United States, arriving on the Albemarle Peninsula in northeastern North Carolina during the early 1990s. Thanks to innovative and intensive field management of both red wolves and eastern coyotes, red wolves now roam 1.7 million acres on the Albemarle Peninsula in northeastern North Carolina. Family groups of red wolves have also lived on each of two island locations for purposes of propagation and translocation to the mainland wild population. These two locations, respectively since 1988 and 1990, are Cape Romain National Wildlife Refuge in South Carolina and St. Vincent National Wildlife Refuge in the Florida panhandle.

The red wolf was first described by Audubon and Bachman (1851). Goldman (1937, 1944) initially described *Canis rufus gregoryi*, *C. r. floridanus*, and *C.r. rufus* as the three red wolf subspecies recognized by biologists. These three subspecies were further confirmed by Paradiso and Nowak (1971, 1972), and the historic ranges of the three red wolf subspecies were adjusted by Nowak (2002). The only surviving red wolf subspecies is likely *C .r. rufus*, according to Nowak (2002), so this subspecies was restored to North Carolina in what is now the world's only free-ranging red wolf population.

Appendix C – Notes About Red Wolf Origin, Taxonomy, Genetics and Management

The U.S. Fish and Wildlife Service must use the best available scientific information and data in evaluating red wolf status, including genetics, morphometrics, palentological, geographical, ecological, behavioral and historical information (Dowling 1992, Cronin 1993, Crandall et al. 2000). In our discussions with lead scientists involved in wolf taxonomy, there exists consensus that the red wolf is a natural entity worth conserving under the U.S. Endangered Species Act. Constructive debate is occurring primarily with respect to the origin of red wolves, the taxonomic name to assign, and how best to manage red wolves over the long-term.

Gene introgression is not unique to red wolves. In fact, Lehman et al. (1991) documented coyote gene introgression into gray wolves, and Adams et al. (2003b) documented dog gene introgression into coyotes, while Kolenosky and Standfield (1975) described hybridization among canids in eastern Canada. Hybridization and gene introgression occur naturally as part of evolutionary processes among many species of fauna (Allendorf et al. 2001, Grant and Grant 1992, Kraus 1995, Mallet 2005, Schwartz 2004, Smith 2003). However, hybridization and introgression caused by humans can also endanger fauna to the point of extinction (Frederickson and Hedrick 2006, Rhymer and Simberloff 1996).

In the past, questions about the hybrid or genetically introgressed nature of a species caused some people to reconsider whether or not species should be conserved or restored (Brownlow 1996, Geise 2006, Kraus 1995). Yet, in select cases, species hybrids can be used as scientific tools to effectively manage endangered wildlife populations. For example, gene diversity and overall survival in Florida panthers (*Puma concolor coryi*) have improved using genes of Texas cougars (*Puma concolor stanleyana*) as “genetic rescue” tools (Creel 2006; Pimm et al. 2006). The Red Wolf Recovery Program uses a different set of scientific tools to improve genetics of the restored red wolf population. Refined genetics-based field techniques and protocols (Adams 2006, Adams and Waits 2006, Adams et al. 2007, Fazio et al. 2005) allow us to use hybrid canids as tools to purge coyote genes and retain red wolf genes in the restored red wolf population (section 2.3.1.d, above). Part of this strategy involves removal of any back-crossed canid found.

Appendix D – New Information Pertinent to Red Wolf Population Management

Beck (2005) described various aspects of field biology and management of red wolves in coastal North Carolina. She modeled introgression as a "disease" and confirmed that non-wolf (coyote or hybrid) survival rates are effectively controlled by the combination of den visits, sterilization of non-wolf adults, and euthanizing non-wolf litters. She calculated red wolf home range sizes from 6.4 to 222.4 square kilometers, where field biologists know home range size varies depending upon availability of prey, habitat, disturbance, and other factors. She also confirmed there is no significant effect on survival of pups from annual den visits at pup ages 5 to 19 days for handling, blood collection, and transponder placement for identity.

Mauney (2005) used geographic information systems to examine red wolf home range and habitat use in the Great Smoky Mountains National Park in western North Carolina and eastern Tennessee. Red wolf restoration was attempted there until 1998 when a decision was made to discontinue (Henry 1998), moving all remaining red wolves to northeastern North Carolina. Mauney (2005) found mean home range size in square kilometers to be 18.44 for males and 18.98 for females with no significant difference between sexes. Red wolves used pasture and deciduous forest habitat more than expected, using mixed and evergreen forest less than expected. Red wolves used slopes under 20% more than expected and used steeper slopes (>20%) less than expected.

Hinton (2006) examined home range, habitat use and pup attendance by red wolves during the pup rearing season in the restored red wolf NEP. He reported mean home range sizes in square kilometers of 74.1 (average overall), 76.1 (adults), 88.9 (juveniles) and 61.5 (pups). Pups implanted with abdominal transmitters in a pilot study showed red wolves used multiple rendezvous sites during the pup rearing season. Pups were moved by adults into adjacent agricultural fields from woodland dens during summer months. Yearling and breeding females attend pups more frequently than do yearling and breeding males. Red wolf pups were rarely alone, indicating pup rearing is shared, with males playing a significant role.

McLellan and Rabon, Jr. (2006) discussed the soft-release technique as a way of translocating adult red wolves into the free-ranging North Carolina population. They reported that use of a portable, electrified corral is an effective method for soft release of male-female paired red wolves. Releases using solitary wolves showed mixed results, where solitary wolves failed to pair with a mate and failed to defend territory.

Additional advances have occurred in our knowledge of red wolf physiology. Crissey et al. (2001) report serum concentrations of cartenoids and vitamins A and E in canids and ursids. Young et al. (2004) demonstrate non-invasive monitoring of adrenocortical activity in carnivores using feces; these are techniques important in the study of red wolf behavior, reproduction and disease. Larsen et al. (2002) and Sladky et al. (2000) discuss cardiorespiratory effects of immobilization drugs on red wolves, knowledge important to red wolf health and safety during handling activities in the field and in captivity.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW OF THE RED WOLF

Current Classification: Endangered Throughout Its Historic Range
Non-essential Experimental In Declared Areas in NC

Recommendation resulting from the 5-Year Review

__X__ **No change is needed**

Review Conducted by: Bud Fazio, Team Leader, Red Wolf Recovery Program, USFWS

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approval Buddy B. Fazio Date 9/26/07

REGIONAL OFFICE APPROVAL:

for **Lead Regional Director, Fish and Wildlife Service**

Approve Maren E Welch Date 9/28/07

Cooperating Regional Director, Fish and Wildlife Service

_____ Concur _____ Do Not Concur

Signature ______________________________ Date ____________________

U.S. Fish & Wildlife Service

Red Wolf News

Volume 3, Issue 1

October 2001 through June 2002

July, 2002

Wild red wolf population in Northeastern North Carolina

? Red wolf population is estimated at 100, 72 of which are radio collared. Twenty-one sterilized hybrids and coyotes are also radio collared and hold space.

? Red wolves range over about 1.5 million acres of public and private land.

Red Wolf News Long Overdue

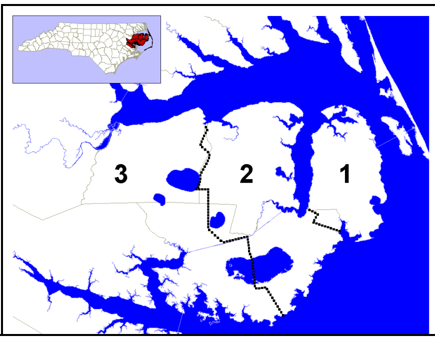
Two years have passed since the last edition of Red Wolf News. Since then, many faces have changed but the dedication to red wolf recovery remains strong. Jennifer Gilbreath, who once handled red wolf outreach and education left in 2000, and her presence has been truly missed. That same year, Biological Technician Leslie Schutte came on board, and with the help of Biologist Chris Lucash and many hard working telemetry interns, they began an extensive mobile ground telemetry program for the monitoring of red wolf movements. In 2001, Bud Fazio became the new Team Leader for the Red Wolf Recovery Program, and this year, Shauna Baron has joined the team to handle our long overdue outreach needs.

Adaptive Management Plan: Update 2002

Interbreeding (hybridization) between red wolves and coyotes is a threat to the survival of the highly endangered red wolf. In 1999, the U.S. Fish and Wildlife Service partnered with a variety of scientific experts to conduct research and design an Adaptive Management Plan to better understand the interbreeding phenomenon. Original estimates showed that if interbreeding was not controlled, the red wolf would be unrecognizable as a separate species within as few as 3-6 generations (12 to 14 years).

Today, the Red Wolf Recovery Program field team is demonstrating that interbreeding can be managed successfully. By early 2001, the field team has been successful in creating a coyote and hybrid free zone, known as Zone 1 of the red wolf experimental population area. Any known hybrids in Zone 2 are sterile and the frequency of hybrid occurrence in Zone 3 is reduced. These sterile animals hold territorial space until a wolf can take it's place. Only three hybrid litters were found in 2001, and these litters were located on the western edge of Zone 3 where interface with coyotes is expected. In contrast, only one hybrid litter was found this year, and this litter was also located at the edge of Zone 3.

Due to success in implementing the Red Wolf Adaptive Management Plan, the boundaries of Zones 1 and 2 are being expanded to reflect the successful expansion of the coyote and hybrid free zone.



Original Management zones of the red wolf experimental population area, Northeastern North Carolina

In order to establish a healthy and viable population of red wolves, the wolves must be able to defend their territories against other non-wolf canids. Recent observations suggest that red wolves are beginning to displace coyotes and hybrids out of their territories, though confirmation of displacement by red wolves will require further investigation.

The red wolf field team has extraordinary plans for 2002. One effort will focus on removing sterile hybrids from Zone 2. This will allow red wolves to acquire those territories through natural migration or by the insertion of red wolves into those areas by the field team.

Red wolves from the island propagation sites may be released or inserted into the wild population. In addition, captive born pups may be fostered into wild red wolf litters. These methods allow for a unique way to augment the wild red wolf population, increase genetic diversity and enhance the overall survival of wild red wolves.

The Red Wolf Recovery Program continues to make great strides in building the world's only wild red wolf population. Cutting edge work in genetics helps us to understand and manage red wolves better with each passing year, and techniques such as fostering show new hope for achieving milestones in red wolf recovery. The Red Wolf Recovery Program has come a long way in thirty years, and we look forward to even greater success in the future.

2002 Denning Season

Springtime in North Carolina is always exciting, bringing with it the arrival of new red wolf puppies. This spring, 9 red wolf litters have been confirmed with 40 puppies being produced.

In May, the red wolf field team implemented the first fostering of captive born red wolf puppies from a zoo into a wild red wolf litter.

The North Carolina Zoological Park donated two pups, a male and a female, from a litter of six born at the zoo. The pups were implanted with microchips for future identification and were transported to northeastern North Carolina.

Red Wolf Puppies: USFWS

The captive pups were then fostered into a wild wolf den containing two pups of identical age. Last year, this adult female raised six pups and we feel she can easily handle a litter of four.

The female has accepted the captive born pups as her own and all appear to be doing well. The female is being monitored from a distance using radio telemetry and so far she has been attending the den regularly.

Confirmation of the survival of these pups will not come until the Fall when the pups will be large enough to be captured and fitted with a radio collar.

Fostering has been successful among captive wolves and has positive implications for the wild red wolf recovery effort. If successful, the ability to foster captive born pups into the wild enables the USFWS to further enhance genetic diversity and overall survival of the wild red wolf population.

Our special thanks to the North Carolina Zoological Park for their dedication to the red wolf recovery effort.

The captive breeding program: *By Will Waddell, Red Wolf Captive Breeding Program Coordinator.*

Thirty-three Red Wolf Species Survival Plan (RWSSP) cooperators in 20 states now participate in the national breeding program and manage a population of 147 red wolves.

Recently the RWSSP approved a three-year action plan establishing several key areas of focus, including four action items:

1) Continue to develop assisted reproductive technologies (semen banking, fecal hormone profiles, artificial insemination) as part of a long-term strategy for red wolf captive-rearing.
2) Initiate a study to characterize behavior, husbandry and environmental factors in the context of captive reproductive success.
3) Investigate safe, effective and reversible methods of contraception as a population management tool.
4) Increase the number of participants in the RWSSP.

Providing accurate information and educating visitors about the red wolf and the recovery program was also acknowledged as a core action item where the RWSSP can have a positive impact.

Red wolves managed in the captive breeding program provide a safety net to their wild counterparts. The RWSSP continues to serve a vital role in the recovery program and is committed to our long standing partnership with the FWS in efforts to restore red wolves.

The passing of an old friend: Wolf 331M

Wolf 331M, the last of the original captive born adult red wolves released at the Alligator River National Wildlife Refuge, passed away in October of 2001. Life in the wild can be hard work, especially for captive born animals, but wolf 331M outlived his captive born peers, reaching the astonishing age of 13 years old.

He was born at the Bull's Island captive breeding facility on April 21, 1988. He was released into Alligator River National Wildlife Refuge on January 18, 1989, quickly learning to secure food and take care of himself. For twelve years he led a healthy normal life in the wild.

Last fall the red wolf field team received a report of an old wolf sitting by the side of the road. The onset of old age had caused 331M to become disoriented and he was brought back into captivity. His condition continued to deteriorate and the field team made the decision to euthanize him to alleviate his suffering.

His contribution to the wild population and his will to survive will not soon be forgotten. In twelve years he sired more than twenty red wolf pups and his heritage now stretches through four generations. With the arrival of this year's puppies, his memory lives on as his new grandchildren take their place in the wild red wolf population.

This newsletter is a publication of the US Fish and Wildlife Service.
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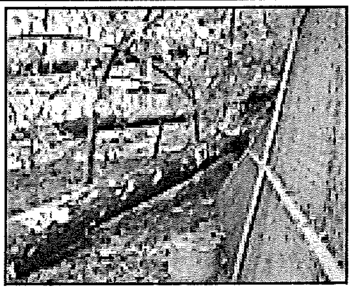
U.S. Fish & Wildlife Service

Red Wolf News

Volume 5, IssueI

Spring, 2004



Captive Facility Recovers from Hurricane Damage

Although Hurricane Isabel made no significant impact on the wild population of red wolves, the Sandy Ridge Captive Breeding Facility on Alligator River National Wildlife Refuge is still recovering from the destructive effects of the storm. Pens that received minor damage have mostly been repaired. Of the eight pens that were severely damaged, three have been fixed and are usable. A new perimeter fence was recently completed.

Thanks to the rapid response of concerned members of the non-profit organization the Red Wolf Coalition, a donation of $7,150 worth of fencing materials will aid the reconstruction of Sandy Ridge tremendously. Now that the fence is erect, fencing materials donated by the Red Wolf Coalition will be shipped to the site and stored inside the compound. These materials will be used to repair the five remaining damaged pens. The USFWS Red Wolf Recovery Program extends gratitude to the Coalition for helping restore this important facility.

For More Information: www.redwolves.com

Fostered Wolf Recaptured and Released

The recent recapture and release of red wolf 11202F on November 11, 2003 was an exciting moment for those involved in maintaining both the captive and wild populations of red wolves. 11202F is not your average wild red wolf. In fact, she and her brother were famous at a very early age.

Born in the North Carolina Zoo in the spring of 2002 to a captive-bred mother, the two pups began their first adventure before they even began to walk. Under the direction of the Red Wolf Species Survival Plan (RWSSP), the body that coordinates the red wolf captive breeding program, the ten-day-old pups were transported from the zoo to northeastern North Carolina on May 5th, 2002. The pups were implanted with a microchip for future identification and inserted by the USFWS into a wild den with two red wolf pups of identical age. The zoo pups were accepted by their wild foster mother and raised along with their adopted siblings.

Captive-born red wolves are periodically inserted into the wild in order to enhance the genetic diversity of the wild red wolf population of northeastern North Carolina. However, the fostering event marked the first time that zoo-born wolf pups were inserted into a wild litter. Previous insertions of captive red wolves were made with young adult wolves. Fostering the pups at an early age allows the pups to be raised by a wild mother, therefore increasing their chances of survival.

11202F awaits her rerelease to the wild.

According to observations by USFWS field biologists, the experimental fostering event is a success. Not only were the zoo-born pups accepted into the wild litter, but they have remained with their adopted pack even longer than the parents' natural pups of the same year's litter. It is thought that the fostered pups, now yearlings, are helping raise their pack's 2003 litter.

As other pack members go off to hunt, they often leave one or two members behind to "pup-sit." The fostered yearlings, particularly 11202F, were often located in the areas where biologists suspected the pack hid their 2003 litter during the summer. This behavior suggests that the zoo-born wolves are fully adapted to the wild and doing their part to participate in the typical pack structure of wild red wolves.

To view footage of the release, visit: www.fieldtripearth.org

Where Do Red Wolves Go When They Die?

All dogs may go to heaven but most wild red wolves go to the National Wildlife Health Center in Madison, Wisconsin. Ever since the restoration of the first four pairs of red wolves to northeastern North Carolina, recovery program biologists have sent the remains of red wolves killed in the wild to the research center operated by the United States Geological Survey (USGS).

The National Wildlife Health Center (NWHC) is a medical laboratory whose mission is to provide information, technical assistance, and research on national and international wildlife health issues. NWHC scientists perform necropsies on red wolves, providing detailed information about the medical condition of the animal in question, as well as the cause of death. Necropsy reports provided by NWHC are compiled in a long-term database tracking red wolf health.

Biologists rely on the wolves' radio tracking collars to tell them when an animal has died. When a red wolf does not move for six hours,

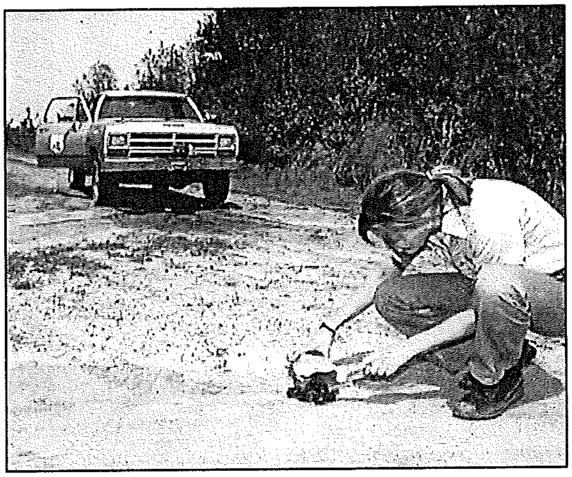
(Continued on Page 2)

Scat!

Evidence of the Red Wolf

Red wolf biologists are using an interesting tool to learn about wild wolves. Scat, the solid remains of a wolf's last meal, can reveal a great deal of information about individual wolves, and the wild red wolf population, as a whole.

When conducting a scat survey, biologists ride All Terrain Vehicles (ATVs) throughout the network of dirt roads within the red wolf recovery area, collecting red wolf feces as they go. By examining the size and consistency of scat, biologists conclude whether or not a specimen belongs to a red wolf. Because wolves consume nearly their entire prey, their scat is encased in hair so that bone fragments do not puncture the intestines. Biologists collect part of the specimen, leaving behind a sizable amount. Biologists are careful not to remove the entire scat because red wolves use scat as markers to delineate their territories.



A biologist collects a sample of red wolf scat.

Initially, scat was analyzed solely to determine the diets of wild red wolves. Collected scat was dried in a special oven and biologists sifted through the undigested matter to determine what the wolves were eating. Hair, teeth, and bone fragments were matched to prey species. By studying the composition of feces over several years, biologists became more familiar with the eating habits of the red wolf.

Thanks to recent progress in genetic testing, scat now reveals much more than diet. Currently, scat collected in the field in northeastern North Carolina is shipped to the University of Idaho, to be analyzed by doctoral candidate Jennifer Adams. Adams tests each scat to determine the genetic identity of the animal that produced the fecal matter.

This non-invasive method of genetic testing is an important tool in adaptive management, the recovery program's process of managing for hybridization with coyotes. "We recognize that hybridization is a serious threat to the red wolf. A key part of the adaptive management plan is to identify canids [in the recovery area] that are unknown," explains Art Beyer, Field Coordinator for the Red Wolf Recovery Program. Scat analysis tells biologists whether canids in a particular area are red wolves, coyotes or coyote-red wolf hybrids, information that might otherwise be difficult to discern. Art explains that genetic information from scat samples gives the program a "high-resolution picture of a canid so that we can decide how it fits into our management plan."

The work of researcher Jennifer Adams and the University of Idaho increases the ability of recovery program biologists to effectively manage for the conservation of the endangered red wolf. As technology evolves and new questions are posed by researchers, scat studies will likely provide additional answers about red wolf behavior and biology.

Where Do Red Wolves Go.... *-Continued-*

its radio collar emits a mortality signal. Biologists can then locate the animal and collect its remains. Even when the cause of death is evident, such as when a wolf is struck by a vehicle, the carcass is sent to NWHC. In the case of suspected illegal activity, the red wolf will be sent to the National Fish and Wildlife Forensics Laboratory in Ashland, Oregon. Forensic scientists at this wildlife crime lab provide information to law enforcement officers working on a case.

In the history of the red wolf recovery program, the single greatest cause of death appears to be vehicular collisions. A total of 38 wolves have been killed by collisions since the recovery program's inception in 1987. Of the natural causes leading to mortality, the greatest cause of death is known as intraspecific strife, a.k.a. "wolves killing each other." Red wolves are extremely territorial and will defend their territory or social rank sometimes to the point of death. Because of the hazards and hardships of life in the wild, red wolves rarely die of old age, though, once in a while, a few oldtimers beat the odds.

Red Wolf News

A publication of the United States Fish and Wildlife Service.

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For more information, visit:
http://alligatorriver.fws.gov
www.fieldtripearth.org
www.redwolves.com

U.S. Fish & Wildlife Service

Red Wolf News

Volume 3, Issue 2 | July 2002 through November 2002 | December 4, 2002

Wild red wolf population in northeastern North Carolina

* Wild red wolf population is estimated at about 100, 63 of which are radio collared. Fifteen sterilized hybrids and sterilized coyotes are also radio collared.

* The sterilization of hybrids and coyotes allows sterile canids to hold territorial space until wolves can replace them.

* Red wolves range over 1.5 million acres in northeastern North Carolina including public and private lands.

Note: The July 2002 newsletter contained an error in the number of collared animals. It should have read 58 wolves and 17 collared hybrids and coyotes.

Bulls Island Wolves Come to North Carolina

In late September, two wolves from the Bulls Island Red Wolf Propagation Site were transferred to Alligator River National Wildlife Refuge in North Carolina. The 18-month-old siblings, one male, one female, arrived in excellent health and will be released separately this fall to join the world's only wild red wolf population.

Bulls Island, located on the Cape Romain National Wildlife Refuge off the coast of South Carolina, is one of two unique breeding locations for the highly endangered red wolf. The second location is St. Vincent Island off the gulf coast of Florida.

Wolves born on the islands are able to experience life in the wild. It is somewhat like "Wolf Boot Camp." Young wolves raised in a wild island environment will acquire the survival skills needed for a successful life on the mainland.

The insertion of young adult wolves into the wild population requires a series of events to occur before a release. The red wolf recovery field team must first monitor the wild population to determine suitable release sites. Optimum release sites include areas where each animal could potentially find a mate and one day reproduce.

Once a release site has been chosen, a procedure known as a soft release will be implemented. An acclimation pen will be set up to hold the wolf, allowing the animal to become familiar with the local area. This will also allow for familiarity with resident wolves.

(Continued on page 2)

The Importance of Radio Tracking

Tracking wolves with hand-held telemetry unit.

Until recently, little was known about wild red wolves. Their early extinction in the wild had left researchers with a limited knowledge of their movements and social behavior. With the 1987 return of the red wolf to northeastern North Carolina, biologists are now able to study wild red wolves once again.

In order to study these elusive animals, biologists rely heavily on radio telemetry to track the animals. Each animal is fitted with a radio collar that emits pulse signals or "beeps" which red wolf biologists monitor with a radio receiver. Each collar emits a unique signal, enabling the biologists to identify individual wolves.

Currently, 63 wild red wolves and 15 sterilized hybrids and coyotes are fitted with radio collars. They are monitored with ground telemetry five days a week and with aerial telemetry two to three times a week.

Many of the animals inhabit areas with dense vegetative cover which makes tracking difficult. To improve our tracking abilities, biologists installed an advanced mobile tracking system that utilizes duel antennae mounted to the top of each vehicle.

A Global Positioning System (GPS) is also used to record the vehicle position while taking telemetry readings.

(Continued on page 2)

Bulls Island Wolves Continued...

After three to four weeks within the pen, the door will be opened and the animal will be able to venture out on its own.

A soft release has been implemented with the Bulls Island male red wolf. On October 10, a site was chosen for the young male. He was then placed in an acclimation pen on Alligator River National Wildlife Refuge.

Biologists monitored the area daily, looking for signs of resident wolves visiting the pen. Within a few days, they picked up telemetry signals coming from the collar of a resident female red wolf in close proximity to the pen.

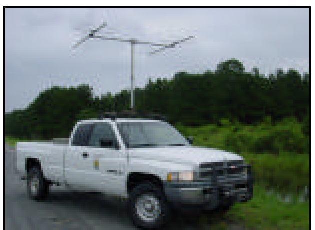
After a few weeks, biologists opened the pen and the male wolf 11166 M stepped out onto new ground. He has currently taken up residence near the release site. We hope that he will form a pair bond with the resident female to produce pups in the spring.

Meanwhile, the red wolf field team is monitoring the wolf population to determine a release site for the 18-month-old female.

This method of inserting 18-month-old wild red wolves offers a unique way to supplement the wild red wolf population, to enhance their genetic diversity and increase their overall chance for survival.

The NC Zoo Website will feature video footage of the Bulls Island wolves later this year.
Go to: www.nczooredwolf.org

The Importance of Telemetry Continued...



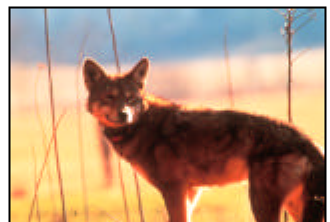
Mobile Telemetry Vehicle

With help from the large vehicle antennae, signals can often be received up to two miles away. The data obtained from the telemetry surveys is then loaded into a software program which can locate animals to within a few meters.

The information gained from telemetry data is highly important to red wolf recovery. Telemetry provides data on red wolf locations, movements, home ranges, social structure and behavior, as well as interactions between neighboring wolf packs and interactions between wolves and coyotes.

Data continues to be collected to examine the hypothesis that coyotes will become increasingly displaced by red wolves as the wild wolf population grows. Early evidence suggests that some red wolves are beginning to displace coyotes out of their territories, but further research is needed to confirm or reject this hypothesis.

If the red wolf can once again defend its territories against coyotes, the level of effort needed to manage red wolves may one day be reduced.



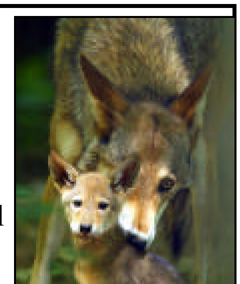
Collared Red Wolf, Photo by Barron Crawford

Searching for the Pamilco Pack

In late August, red wolf field biologists lost contact with two collared wolves of the Pamlico Pack which typically range throughout the southeastern portion of Alligator River National Wildlife Refuge. The two wolves disappeared shortly after a wild fire broke out in the area. Extensive ground and aerial telemetry surveys as well as track surveys have failed to locate the wolves. The biologists will attempt siren surveys in hopes of hearing a howling response from animals in the area.

Captive red wolf population and Island Programs

There are approximately 160 adult wolves in captivity at 37 facilities nationwide. There are 2 wolves on Bulls Island at Cape Romain National Wildlife Refuge off the coast of South Carolina, and 2 wolves reside on St. Vincent Island National Wildlife Refuge off the coast of Florida.



Adult male red wolf with pup at the Museum of Life & Science, Durham, N.C. Photo by Greg Koch

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For More Information Go To: **alligatorriver.fws.gov** ***Or*** **www.nczooredwolf.org**
Or **www.redwolves.com**

U.S. FISH & WILDLIFE SERVICE

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Red Wolf News

Volume 5, Issue 2 Summer, 2004

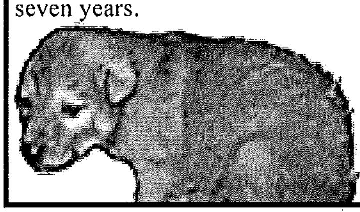
The First Year

Each year in April and May, wild red wolf puppies are born. At birth, the pups weigh less than a pound, have their eyes closed shut and their ears pressed down. The pups squirm in a pile, safe in their dens. The pups' ears pop up within 10 days and usually a week later, their cobalt blue eyes open.

By about four weeks old, the pups are able to wander out of the den, staying near the den entrance. At six weeks, the pups begin spending more time outside of the den and by 8-9 weeks, the pups are weaned and learning to hunt mice and other small prey. The pups grow rapidly. In the late fall, when the pups are 8-10 months old, they have an adult-sized frame and biologists are able to fit them with radio collars.

For a red wolf puppy, the first year of its life is a critical time for learning, growing, and most of all, surviving. Disease and predators are daily challenges for young red wolves.

On average, only half of all pups born each year in the wild will survive their first year. Those who survive, however, will likely live an average of seven years.



Exciting Year for Red Wolf Pups

Every spring, field biologists with the Red Wolf Recovery Program listen for the squeaky whine of young red wolf pups as they search beneath logs, in the pocosin thickets, and in brush pile burrows for red wolf dens. When biologists locate dens, each pup is counted and tagged and blood samples are collected before it is carefully placed back in its den. This annual census occurs during "puppy season," early-April through late May. This spring, red wolf biologists had a record-breaking puppy season, as the team located 11 dens with 55 pups and added two more puppies to the count via fostering.

Captive-to-wild fostering events are coordinated efforts by the USFWS Red Wolf Recovery Program and the American Zoo & Aquarium Association's Red Wolf Species Survival Plan (RWSSP). Fostering is a new method which allows genetically valuable captive-born red wolf pups to become integrated into the wild red wolf population. The pups develop in the wild, so that they gain survival skills required to mature and reproduce. "This technique is effective," explains Art Beyer, Field Coordinator for the Red Wolf Recovery Program, "when the fostered pups live long enough to contribute their genes to the wild population by producing pups of their own."

This spring, in addition to the two new 2004 arrivals, the USFWS Red Wolf Recovery Program was able to measure the success of a previous 2002 fostering attempt. It was this time two years ago when a bold experiment placed two pups from the North Carolina Zoological Park into a wild den containing two pups of identical age. The male and female pups were successfully adopted by their wild foster mother and raised within the pack. During the following spring of 2003, the two captive-born yearlings remained with their adopted pack and helped raise a new litter of pups. This

One of two female red wolf pups born on Bulls Island at Cape Romain National Wildlife Refuge in South Carolina awaits her transfer to a wild den in northeastern North Carolina.

spring, biologists were hopeful that each of the zoo-born red wolves would produce litters of their own.

The male zoo-born wolf, displaced from his adopted pack and forced to establish a range of his own, was successful in securing the alpha position of another established pack, just in time for breeding season. Biologists are celebrating the discovery of a litter of eight puppies that was fathered by the zoo-born male. This rather large litter denotes success for the 2002 fostering attempt. "This event demonstrates that the captive breeding program and the free-ranging population are integral aspects of the Red Wolf Recovery Program. They still depend greatly on each other for the recovery of the species," explains Will Waddell, Coordinator of the RWSSP Captive Breeding Program.

In mid-April, a telemetry intern detected a mortality signal from the zoo-born female's radio tracking collar. A mortality signal is produced when a red wolf does not move for six hours. When the female's body was recovered, all symptoms pointed to complications with pregnancy. "We are saddened at the loss of this zoo-born female and her unborn pups, but are encouraged by her ability to adapt successfully to the wild before dying of natural causes," comments Buddy Fazio, Team Leader of the Red Wolf Recovery Program.

Teacher Workshop Brings the Red Wolf to Classrooms

A workshop participant prepares to pour plaster into a wild red wolf track.

Does playing games and tracking red wolves sound like fun to you? Well, it was all in a day's work for the sixteen educators from across North Carolina who attended the first-ever Red Wolf Recovery Teacher Workshop at Pocosin Lakes National Wildlife Refuge on May 25th. The one-day workshop attracted teachers and park rangers who were hoping to learn more about the recovery of one of America's most endangered mammals and, in the meantime, enhance their curricula and repertoire of environmental education activities. Participants were especially excited about the opportunity to scout for signs of red wolves in the wild and pour plaster casts of their tracks.

The workshop, which can be counted toward the North Carolina Environmental Education Certificate and qualifies as a Continuing Education Unit for school teachers, will be held periodically each year. In exchange for the free workshop, each participant must commit to teach at least one lesson based on the red wolf curriculum. "The workshops are mutually beneficial," explains Outreach Coordinator, Sarah Krueger, "teachers and red wolves alike profit from the experience."

Learn More About Our Educator Resources, Visit:
http://alligatorriver.fws.gov/redwolf.html

Love Connection: Biologists Pair Red Wolves to Form New Packs

Red wolves are extremely social animals that rely on their family groups for survival. The bond between the two breeding wolves of each family group is vital if a pack wants to establish and maintain a territory. However, there comes a time when nearly every red wolf must fend for itself, whether it is a young wolf dispersing from its natal pack or a red wolf that has lost its pack mates.

The lone red wolf is vulnerable to the encroachment of neighboring packs as well as the threat of pairing with a non-wolf mate. A red wolf who cannot locate a suitable red wolf mate may sometimes pair with a coyote or hybrid. If the two animals breed, they can create a litter of hybrid pups who threaten the integrity of the red wolf species. If the non-wolf mate has previously been identified, surgically sterilized and given a radio collar by Recovery Program biologists, there is hope that the red wolf in question may be introduced to a more appropriate mate.

Although the majority of red wolves find suitable mates on their own, the Red Wolf Recovery Program's Adaptive Management Plan to control hybridization calls for the field crew to occasionally create red wolf pairs in areas where non-wolves may infringe on the population. In essence, red wolf biologists sometimes act like match-makers for red wolves, usually lone wolves who occupy the western most territories of the recovery area, as these are most at risk for pairing with a non-wolf.

During the last breeding season, red wolf biologists attempted four pairings, three of which resulted in successful pair bonds. One "love story" involves a three year-old female, 11163F, who was occupying a territory in an isolated area that was not a natural travel corridor for red wolves. Fieldwork suggested that she did not have a mate and there were concerns that a non-wolf might attempt to fill the void. Luckily, biologists picked up two year-old 11188M, who had dispersed from his natal pack and was traveling an area that was already crowded with established wolf packs. It was the ideal opportunity to take a wandering lone male and introduce him to a female who had established territory in an area devoid of other known wolves. 11188M was caught and then immediately released near 11163F. The two wolves soon found each other and telemetry observations indicate that they have bonded and are maintaining a territory.

Of course, the process is not always so simple. Sometimes matchmakers must work a little harder to make a "love connection." Oftentimes, a potential pair will be held during breeding season for six to eight weeks in captivity and then released together. Each match-making attempt is slightly different, depending on the circumstances of the mates-to-be. Biologists can never force wolves to pair, but it is a technique that is worth the effort. "Creating pairs is a unique opportunity to boost red wolf productivity while managing the threat of hybridization," explains Recovery Program biologist Michael Morse. Although red wolves have their share of ill-fated romance, those pairs that do bond and breed will help the rest of the red wolf species live "happily ever after."

Red Wolf News

A publication of the United States Fish and Wildlife Service.

Please address questions and comments to:

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For more information, visit:

http://alligatorriver.fws.gov
www.fieldtripearth.org
www.redwolves.com

Summer - 2007 U.S. Fish and Wildlife Service

Red Wolf Journal

2007 Red Wolf Recovery Program Highlights:

- 31 pups born (11 (females; 20 males)
- 21 packs as of 7/2007
- RIT will meet in Oct., 2007
- 4 red wolf pairs released 20 years ago ARNWR
- Red Wolf Coalition brings $10,000 wolf exhibit to Columbia, NC
- Read new field notes at: www.fws.gov/alligatorriver/redwolf

More inside . . .

Note: The "Red Wolf Journal" replaces the "Red Wolf News." Comments welcome.

Pup Season - 2007

Red wolf biologists spent another spring searching for elusive red wolf litters. During April and May, they searched the 1.7 million acres of the recovery area by land and in the air looking for pups.

To date, they report finding 31 pups; 11 females and 20 males in 11 packs.

The number of packs with pups for 2007 is similar to that of 2006, but the 2007 litters have been smaller. As of July, there have been 21 packs identified in the 5-county recovery area but some consist of just a red wolf pair. Pack numbers change as single wolves find mates or deaths occur among the breeding population.

This is a very rewarding time of the year, according to the red wolf biologists. Finding pups is a good indication that red wolves are thriving in their home range and population numbers should continue to climb.

From 8 red wolves to 100+ in 20 years, is indeed a reason to be optimistic.

▼Yes, that's Chris.

2007 litter

Pup Highlights

ALL IN A DAY'S WORK

Saved by red wolf biologists! During regular field operations, red wolf staff wildlife biologists found a den of pups, just feet from a farmer's large excavator.

< Ford Mauney, wildlife biologist, with rescued pups >

2007 litter

Fostering

Chris Lucash introducing a fostered pup into a Beech Ridge pack den.

Fostering has been a valuable component in red wolf recovery efforts for five years. This program continues to meet with success. There has never been a case of pup rejection by the wild parents or siblings.

Increasing numbers and strengthening red wolf genetics are two primary reasons behind fostering events. As most of you know, Species Survival Plan members meet annually to review genetic lines of both the captive and wild red wolf populations. During these meetings, decisions are made to help identify litters for fostering events needed during the next year's pup season.

Two fostering events took place during 2007:

> A male and female pup into the Beech Ridge Pack. The mom also had one natural male pup.
> One male pup into the Milltail Pack

During 2006 one fostering event took place. Three pups from the Graham Facility in Tacoma, WA, and one pup from Oglebay's Good Zoo, Wheeling, WV, were introduced into the Sunnyside pack. Graham provided 2 females and 1 male and Oglebay sent 1 female.

Yearling Gets His First Collar

This Milltail Pack male yearling was trapped over the summer in order to fit him with a radio tracking collar. Often people remark about the size of the collar, but as you can see from the second photo, the device did not slow his fast return to home range territory. Maybe someday a smaller battery with additional longevity will be invented and red wolves and other wildlife will benefit.

Captive Corner

Red wolf captive population reports from Will Waddell at Point Defiance Zoo and Aquarium state that there are currently 207 red wolves in 38 captive locations across the U.S. There will soon be two more Red Wolf Species Survival Plan (RWSSP) locations added to this number: one in Maryland and one in Illinois.

There were 15 litters in 2007 (RWSSP) with a current total of 51 live pups as of this writing. Pup season is always an exciting time, resulting in increased public and media interest, especially for the captive facilities. In Manteo, we enjoy reading the news articles about the new pups and appreciate the forwarded newspaper articles – or any stories about the new pups.

Video cameras showing pup exploits offer an even greater opportunity for visitors to actually see live canid activity. What an educational tool! Maybe someday, if "National Geographic Magazine" and others get their way, there will be cameras videotaping den activity in the wild population even though this will be more difficult to implement and manage logistics. (More on the captive population and Recovery Implementation Team (RIT) in the next "Red Wolf Journal" edition. The RIT plans to meet this October.)

Red Wolf Coalition

The Red Wolf Coalition (RWC) has taken on a major project this summer in the form of a wolf exhibit featuring six canid mounts at a cost of $10,000. The "Wolves and Wildlands in the 21st Century" originates from the International Wolf Center (IWC) in Ely, Minnesota.

The bulk of the expense was absorbed by the RWC, with contributions from USFWS, Defenders of Wildlife, Tyrell County Ecotourism Board and private contributors.

The exhibit is housed at the Walter B. Jones, Sr., Center for the Sounds Visitor Center at the Pocosin Lakes National Wildlife Refuge in Columbia, North Carolina, in the heart of red wolf territory.

Thanks to the generosity of the IWC, the exhibit will remain in place until the end of October, 2007, rather than mid-August as originally agreed.

This free, self-guided, interpretive exhibit has life-size mounts of the red wolf, Mexican wolf, Arctic wolf, Rocky Mountain wolf, Great Plains wolf and a coyote. There have been many positive responses in the visitor log book, sales have increased in the visitor center gift shop, and more people are learning about wolves!

By keeping the exhibit until after schools start, it is hoped that area teachers will consider bringing students to see the exhibit. Red wolf education programs will also be offered for classes viewing the canid display.

Howling safaris are a hit again for 2007. This season there is a $5.00 per person charge, but that has not lowered the attendance numbers.

The Red Wolf Coalition (RWC) is a non-profit organization dedicated to promoting red wolf recovery through education, outreach and research. (www.redwolves.com) 252-796-5600

Outreach Corner

The Red Wolf Recovery Program has participated in a variety of events over the last several months.

The photo below was taken at the annual Dixie Deer Classic held at the Raleigh, NC, fairgrounds. This event attracts thousands of sports enthusiasts including hunters, fishing fans, trophy hunters, guides, and vendors of every sort.

Kim Wheeler, RWC, visiting with hunters at the FWS/RWC booth.

Additional events include the NC Wildlife Arts Festival held in Washington, NC; Music and Water Festival in Edenton, NC; Wright Bros. Memorial education event, Kill Devil Hills, NC.

Discovery Boxes continue to travel to educators across the country. Even though there are three now in circulation, the number of requests can still pose scheduling problems. Two books have been added to their contents, "Wolves and Wild Dogs" compliments of Cornelia Hutt, RWC, and "The Red Wolf" as a result of a partnership effort between RWC and FWS.

The "Far Traveler" teacher curriculum has been updated and is in the FWS Region 4 office in Atlanta awaiting final edits. Much kudos to Cornelia "Neil" Hutt, RWC, for her major editing assistance on this document.

Partnership education efforts between the RWC and the Red Wolf Recovery Program promoted expanded school visits for 2006-2007 as well as community presentations for the following:

- Providence Elementary, VA
- Columbia, NC, schools
- First Flight Middle School, Kill Devil Hills, NC
- Fairfield Elementary, VA
- Sierra Club Presentation
- Festival Park, Manteo, NC

Media coverage has increased over the months as well. The "Virginian Pilot," Raleigh's "News and Observer," Manteo's "Coastland Times," and various magazines have all written about a favorite subject: howling safaris.

All of the education and outreach efforts done throughout the year at captive facilities are very much appreciated by the Red Wolf Recovery Program.

U.S. Fish and Wildlife Service

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We're on the Web!
See us at:
www.fws.gov/alligatorriver/redwolf

Species Survival Plan Educators Summit

The Red Wolf Recovery Program is eager to welcome to the recovery area the Species Survival Plan (SSP) Educator Summit. Pamela Rout and Craig Standridge, Red Wolf SSP Advisors and Summit Coordinators, have put together an information-packed agenda with optional activities that include a howling safari and a canoe trip on the Alligator River National Wildlife Refuge. This event is scheduled for October 26 and 27, 2007, in Manteo, NC - a perfect time of the year to visit the Outer Banks of North Carolina.

What a great opportunity for Red Wolf Recovery Program staff to connect with captive facility educators! This will be a terrific forum to trade ideas, exchange information on what works and what can be improved, and put many names with faces.

Alligator River NWR Office
Manteo, NC

Red Wolf Recovery Program Staff

Bud Fazio, Team Leader
Art Beyer, Wildlife Biologist and Field Coordinator
Michael L. Morse, Wildlife Biologist
Chris Lucash, Wildlife Biologist
Ford Mauney, Wildlife Biologist
Ryan Nordsven, Biological Technician
Diane Hendry, Red Wolf Outreach Coordinator

*The red wolf caretaker is a temporary position. Details can be found on-line at www.fws.gov/alligatorrive/redwolf

U.S. FISH AND WILDLIFE SERVICE
P.O. Box 1969
Manteo, NC 27954

U.S. Fish and Wildlife Service

Summer - 2009

Red Wolf Journal

THIS ISSUE:

- Pup season report
- Bud Fazio accepts position with Mexican Wolf Program
- David Rabon, new Team Leader
- Recovery Program replaces admin. person
- Exciting new SSP education effort
- Captive Corner
- Red Wolf Coalition (RWC) news
- Outreach activity
- Red Wolf Education and Health Care Facility

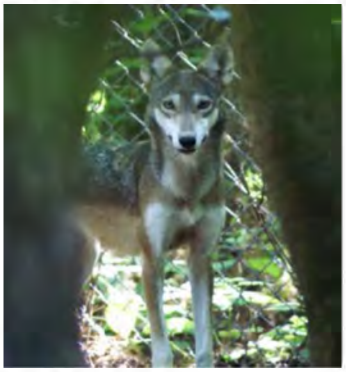
More inside . . .

Note: The "Red Wolf Journal" replaces the "Red Wolf News." Comments welcome.

From the Field

Greetings from the Red Wolf Recovery Program! The restoration area reports a healthy 2009 pup season with four pups (three females and a male) from Lincoln Park Zoo, Chicago, IL, fostered into two wild packs and four pups were born to a captive pair at Sandy Ridge (three males and a female) and are doing well as you can see from the photo below. They are so big now! Eleven wild litters produced 41 pups and the captive population reported 12 pups born among 3 litters (including the 4 fostered pups).

There are currently 75-80 radio-collared red wolves in a total population of about 130 in the 5-county restoration area in northeastern North Carolina. As of this publication, there are 180 red wolves in the captive population.



Kim Wheeler photos: Pups at Sandy Ridge: then and now.

A total of four males and one female red wolf from St. Vincent National Wildlife Refuge in Apalachicola, FL, were released into northeastern North Carolina's wild population this year. Hopefully they will find mates and acclimate well to their new home.

Snow is not a common occurrence during an eastern North Carolina winter. However, Kim Wheeler, Executive Director, Red Wolf Coalition, took this photo of a 2009 winter scene at the Sandy Ridge facility. This red wolf does not seem to mind the white stuff at all.

From the Field (cont.)

Mortality

Field biologists report eight red wolf mortalities in the wild population since early June, but due to the time of year (heat, bugs, and reduced flight time for budgetary reasons) cause of death could not be determined. This number includes breeders as well as dispersing yearlings.

Program Highlights

Change in Leadership . . .

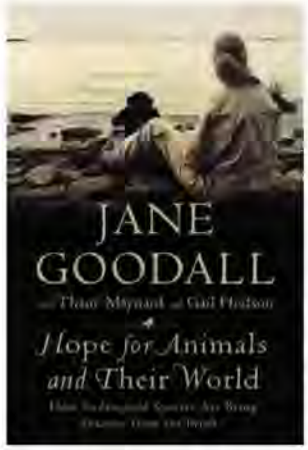
Many of you have heard the news that Bud Fazio, Red Wolf Recovery Program Team Leader, accepted a position with the Mexican Wolf Recovery Program. During Bud's tenure with red wolf restoration, he often came in contact with the western Mexican wolf project so is already familiar with many of the program's issues and goals. He and his family are settled in their new home and Bud is getting acclimated to the western work environment.

David Rabon, currently working for the USFWS Ecological Service office in Raleigh, NC, was selected as Bud's replacement. David is quite familiar with red wolf restoration and recently completed his PhD on the subject at North Carolina State University. We will welcome David to the Manteo office in mid-October. Art Beyer has been acting Team Leader, again, and doing a terrific job.

DOT Study

The recovery program has been part of a North Carolina Department of Transportation (DOT) state/federal partnership to monitor wildlife activity along Hwy. 64. The DOT is investigating the possibility of widening the highway corridor from Columbia to Manns Harbor, NC. As a result of this partnership, DOT has purchased 40 satellite collars to monitor red wolf activity in the study area. USFWS wildlife biologists, ARNWR staff and interns, Duke University, and Virginia Tech **(continued on next page)**

Jane Goodall Book



"Hope for Animals and Their World" *How Endangered Species are Being Rescued from the Brink* is the title of Jane Goodall's latest book book and is co-authored by Thane Maynard and Gail Hudson. A chapter on red wolves is included in the text. Anticipated publication date is September, 2009. More information is available at http://www. hachettebookgroup.com/books_9781600248689.htm.

SSP Update

Will Waddell, Species Survival Plan (SSP) Coordinator, recently sent out a Red Wolf SSP Update and mentioned that the federal Omnibus Bill provided funding to relocate the Graham facility in Tacoma, WA, with a portion of the funds going to the Western North Carolina Nature Center in Asheville, NC.

The SSP report indicated that "about five years of work preceded the spending bill to secure public and private funding to relocate the Graham facility to Northwest Trek Wildlife Park." This site is managed by MetroParks Tacoma, the same local municipality that operates Point Defiance Zoo and Aquarium. The federal grant paperwork has been received in Tacoma and hopefully will soon follow at the Asheville site. More to follow as the $870,000 in funding is spent on projects.

Program Highlights (cont.)

are part of this effort. It will take over a year to analyze the data and complete a proposal. Since satellite collars cost about $3,000 compared to $300-$400 for VHS, the recovery program is grateful for the opportunity to participate in this project. Data received from the DOT study is likely to enhance red wolf research for the USFWS program as well.

The picture and information were taken from an ARNWR news release distributed by Bonnie Strawser, ARNWR Visitor Services Manager.

The route encompasses over eleven miles of barbed wire strung above the guardrail on US Highway 64 through Alligator River National Wildlife Refuge. DNA analysis of the hair will tell researchers what species, and even what individual animal, left this hair as it crossed over the guardrail.

Red Wolf Recovery Program Outreach

Far Traveler

The "Far Traveler" teacher workshop was held on July 23rd at Pocosin Lakes National Wildlife Refuge in Columbia, NC. There was a combination of nine formal and non-formal educators from North Carolina and Virginia at the workshop. (Ten is an ideal number but we have hosted as many as 15 participants.)

The Red Wolf Recovery Program and the Red Wolf Coalition (RWC) co-sponsor the workshops and the RWC donates refreshments. Educators participate in activities from the "Far Traveler" curriculum authored by Cornelia Hutt, RWC Chairperson; talk with a wildlife biologist from the Red Wolf Recovery Program; and go home with the "Recovering a Species" DVD, a howling CD, "Far Traveler" curriculum guide, posters, red wolf pens and literature. They become familiar with a "Discovery Box" and its use for red wolf education. This tool is sent to educators through a reservation system. Workshop evaluations help with future workshop development.

Photo donated by Krista Perry. Michael Morse, Red Wolf Recovery Program staff, talking with workshop participants.

2009 Events

- September 26 Heritage Days in Kitty Hawk, NC
- October 10 Scuppernong River Festival in Columbia, NC
- November 17 Wildfest in Manteo, NC
- November 21 Farm City Festival in Plymouth, NC
- November 5 RWC and USFWS doing a special howling for Wings Over Water event.

A Few Statistics

2009 Fiscal Year to date: 14 Discovery Boxes were sent to educators in NC, TX, FL and VA
26 presentations done for schools, events & community groups
200+ information requests responded to from the general public and media

Red Wolf Coalition

The Red Wolf Coalition (RWC) continues to support red wolf conservation in a number of ways:

- Seeks out funding to build enclosures behind the Red Wolf Education and Health Care Facility in Columbia. (Estimated cost: $80,000)
- Takes the lead on red wolf howlings. The wolves have howled every Wednesday evening but one! (We weren't so lucky in 2007 and 2008!)
- Continue to be a strong partner on outreach fronts (education programs, event participation, community connections, etc.).
- Kim Wheeler, Executive Director of the Red Wolf Coalition, was recently elected as Tyrrell County Chamber of Commerce President, a good community connection. Kim was also the lead nanny at a recent training at the International Wolf Center (IWC) and continues to fill in as caretaker for the Red Wolf Recovery Program when there are lapses in interns.
- Mark MacAllister, RWC Board Member and web site master for www.fieldtripearth.org., announced that this site received Landmark Website" by the American Association of School Librarians (AASL), a division of the American Library Association (ALA). Mark said, "Other Landmark Websites so honored include Library of Congress, NASA, PBS Teachers, Smithsonian Education, Apple Learning Interchange, and Google Earth--as well as some other long-term projects such as WebQuest and EduTopia – good company to be in."
- RWC acts as a strong liaison between the IWC and the recovery program.
- Mark MacAllister continues to contribute a great deal of his time developing the SSP web site, scanning slides and assisting the Red Wolf Recovery Program with 21st century technology.
- The last face-to-face RWC board meeting was held at the Durham Museum of Life and Science, in Durham, NC, and new board member Sherry Samuels provided a guided tour of Museum facilities.

New board members: Sherry Samuels from the Durham Life & Science Museum; David Slaydon, Nylon Account Manager, Unifi, Inc.; and Ann Raspberry, Consulting Ecologist and Geospatial Intelligence Analyst.

Howling Safaris

USFWS photo: Michele Shrader, Volunteer registering howling participants.

People, wolves, bears and alligators . . . plus snakes, birds, frogs, deer, bugs and jets all make for an interesting howling safari evening on the ARNWR. As we near the end of summer, nearly 700 participants have heard red wolves howl in the night as well as frogs croaking and jets flying. Bears are seen nearly every week as cars caravan slowly through the refuge to the howling site. Visitors often come back the next day for another look. Every now and then an alligator has been spotted in a canal alongside Hwy. 64 or a paddler has seen one on a refuge water trail. Great egrets and many other species of wildlife call the refuge home and are quite willing to share the space with their neighbors – even their human visitors. There is still one more howling to go plus several more free howlings. Additional information can be found at www.redwolves.com.

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Art Beyer, Wildlife Biologist and Field Coordinator
Michael L. Morse, Wildlife Biologist
Chris Lucash, Wildlife Biologist
Ford Mauney, Wildlife Biologist
Ryan Nordsven, Biological Technician
Diane Hendry, Outreach Coordinator
Mary Berrie, Administrative Assistant
David J. Sparks, Caretaker

*The red wolf caretaker is a temporary position. Details can be found on-line at www.fws.gov/redwolf

Red Wolf Recovery Program

Photo credit: Ryan Nordsven, USFWS

1st Quarter Report

October - December 2009

Coordinator: David R. Rabon Jr., PhD
Wildlife Biologists: Art Beyer, Chris Lucash, Ford Mauney, Michael L. Morse
Biological Technician: Ryan Nordsven
Outreach Coordinator: Diane Hendry
Administrative Assistant: Vacant
Intern: David J. Sharp

www.fws.gov/redwolf

The Red Wolf Recovery Program

The red wolf (*Canis rufus*) is one of the most endangered canids in the world. Once occurring throughout the eastern and south-central United States, red wolves were decimated by predator-control programs and the loss and alteration of habitats. By the 1970s, these activities had reduced the red wolf population to a small area along the Gulf coast of Texas and Louisiana. To protect the species from extinction, the U.S. Fish and Wildlife Service initiated efforts to locate and capture as many red wolves as possible for the purposes of establishing a program to breed the species in captivity and one day reintroduce the species into a portion of its former range. More than 400 canids were captured in coastal areas of Texas and Louisiana, but only 17 were identified as red wolves. Fourteen of these wolves would become the founding members of the captive-breeding program and the ancestors of all red wolves existing today.

The first litter of red wolves born in captivity occurred in 1977. Within a few years red wolves were successfully reproducing in captivity, allowing the U.S. Fish and Wildlife Service to consider reintroducing the species in the wild. In 1987, four male-female pairs of red wolves were released in Alligator River National Wildlife Refuge (ARNWR) in northeastern North Carolina and designated as an experimental population. Since then, the experimental population has grown and the recovery area expanded to include four national wildlife refuges, a Department of Defense bombing range, state-owned lands, and private lands, encompassing about 1.7 million acres. However, interbreeding with the coyote (a species not native to North Carolina) has been recognized as a threat affecting the restoration of red wolves. Currently, adaptive management efforts are making progress in reducing the threat of coyotes to the red wolf population in northeastern North Carolina. Other threats, such as habitat fragmentation, disease, and premature mortality, are of concern in the restoration of red wolves. Efforts to reduce the threats are presently being explored.

Program Objectives

The current recovery plan (U.S. Fish and Wildlife Service, 1990) specifies the following objectives:

1) Establish and maintain at least three red wolf populations via restoration projects within the historic range of the red wolf. Each population should be numerically large enough to have the potential for allowing natural evolutionary processes to work within the species. This must be paralleled by the cooperation and assistance of at least 30 captive-breeding facilities in the United States.
2) Preserve 80% to 90% of red wolf genetic diversity for 150 years.
3) Remove threats of extinction by achieving a wild population of approximately 220 wolves and a captive population of approximately 330 wolves.
4) Maintain the red wolf into perpetuity through embryo banking and cryogenic preservation of sperm.

The Red Wolf Population

For the purposes of this report, all population figures are comprised only of known canids (i.e., wolves, coyotes, and/or hybrids that are actively monitored through either a functioning radio-collar or surgically implanted abdominal radio transmitter). Additional wolves, coyotes, and/or hybrids may be present, but have not been captured or their presence otherwise confirmed.

Population and Territory Status

A total of 69 red wolves occupied the Red Wolf Recovery Area (i.e., 1.7 million acres in five counties in northeastern North Carolina) at the end of the first quarter of our fiscal year 2010 (FY 10). The population includes 23 active pack territories (totaling 57 wolves) with 12 breeding pairs. An additional 12 wolves are not known to be associated with a pack (as defined in the Pack Summaries section). Compared to the end of the fourth quarter of FY 09, 68 wolves occupied the Red Wolf Recovery Area, representing 29 active pack territories with 10 breeding pairs.

Wolf Pairings

A breeding pair of wolves was formed during the quarter when staff biologists successfully removed a resident female coyote that was paired with a male wolf, allowing a young female wolf lingering near the territory to pair bond with the male.

Two breeding aged wolves, a male and a female, were captured in September 2009 and placed together in a soft-release acclimation pen in December 2009 in an attempt to form a new pair. Their release is planned for January 2010, pending the capture and removal of a pair of resident coyotes.

Wolf Captures and Radio Telemetry Marking

During this quarter, Red Wolf Recovery Program staff logged approximately 6,100 trap-nights. For that effort, 18 wolves were captured, 15 of which were fitted with radio-collars (either VHF or GPS). The three remaining wolves were young animals and their size precluded fitting them with a collar, thus they were surgically implanted with abdominal VHF radio transmitters. Captured wolves consisted of 10 males and 8 females; five adults (> 2 years of age), four yearlings (1-2 years of age), and nine pups (< 1 year of age).

Mortalities

Ten known wolves (4 males, 6 females) from the Red Wolf Recovery Area died during the quarter, including six attributed to gunshot, one the result of a collision with a vehicle, one the result of natural causes (old age), and two of unknown cause. Mortalities consisted of seven adult wolves (> 2 years of age) and two yearlings (1-2 years of age).

The first quarter corresponds with the rifle hunting season in eastern North Carolina. Gunshot mortality of wolves is typically higher during this quarter as compared to the rest of the year. Since 2005, the Red Wolf Recovery Program has annually recorded between four and six gunshot mortalities during the hunting season. Efforts to reduce gunshot mortalities through hunter education and outreach programs continue to be implemented.

Pack Summaries

For the purposes of this report, the criteria used to define a pack territory include a known wolf maintaining an established territory and is either associating with or has historically associated with another wild canid inhabiting the same territory. Packs identified in the following summaries include a minimum of one known wolf within the quarter being reported.

Milltail Pack (5 collared wolves)

The Milltail pack consists of the radio-collared adult breeding pair (1544M male, 1357F female) and three collared yearlings born in 2008 (1660F, 1661M, and 1662F). Three pups were born in 2009 but have not been captured and radio-collared. Adult pack member (1421M), a sibling to the breeding male (1544M), was found dead in December, but the cause of mortality could not be determined.

Gator Pack (1 collared wolf)

The only known member of the Gator pack is a radio-collared female (1085F).

Lux Pack (0 collared canids)

The radio-collared female (1541F) was killed by gunshot in December.

Hester Pack (1 collared wolf, 1 collared coyote)

The Hester pack consists of one radio-collared male wolf (1333M) and one radio-collared sterile female coyote.

Waupaupin Pack (2 collared wolves)

The Waupaupin pack consists of a radio-collared adult breeding pair (1657M, 1471F). Seven pups were born in 2009 to male 1313M and female 1471F, six of which have not been captured and collared. The remaining pup (1755M) was captured in November after having dispersed west to Pocosin Lakes National Wildlife Refuge (PLNWR). The pups' sire (1313M) was displaced in late summer 2009 by the current breeding male.

Ventures Pack (4 collared wolves)

The Ventures pack consists of the radio-collared adult breeding pair (1185M, 1207F) and two radio-collared yearlings born in 2008 (1705M and 1706F). Four pups were born in 2009 but have not been captured and radio-collared to date. A radio-collared yearling male (1703M) dispersed from this pack in November and became the new breeding male of the Rich pack.

Boundary Pack (0 collared canids)

The radio-collared adult female (1036F) was found dead in November from what appears to be natural causes related to old age. Staff biologists have lost contact with the radio collar of her mate (1439M), likely due to a dead battery. Wolf-sized tracks recently seen within the Boundary pack territory are thought to be his.

Swindell Pack (3 collared wolves)

The Swindell pack consists of the radio-collared adult breeding pair (1540M, 1419F) and one radio-collared yearling (1684M). Three pups were born in 2009, but have not been captured and radio-collared.

Weyerhaeuser Pack (1 collared wolf)

The only known member of the Weyerhaeuser pack is a radio-collared female (1440F).

ICW Pack (2 collared wolves, 2 wolves with abdominal transmitters)

The ICW pack consists of the radio-collared breeding female (1298F), one radio-collared yearling (1708F), and two pups (1780M, 1781M). The pups were captured and surgically implanted with abdominal radio transmitters in November. One additional pup born in 2009 has not been captured.

Kilkenny Pack (2 collared wolves)

The Kilkenny pack consists of a radio-collared breeding pair (1547M, 1170F). This is a new pair, formed in December, when the male was displaced from the Rich pack and in turn displaced Kilkenny's breeding male (1316M). Three pups were born to the previous breeding pair in 2009, and two zoo-born pups were fostered into the wild litter.

West Kilkenny Pack (0 collared canids)

The radio-collared female (1697F) was found dead in October. Her mortality appears to be the result of gunshot. A radio-collared, sterile male coyote was displaced from the territory by male wolf (1547M) shortly after the female wolf's death.

Rich Pack (4 collared wolves)

The Rich pack consists of a radio-collared breeding pair (1703M, 1633F) and two radio-collared pups (1741F, 1774M). The male appears to have recently displaced the pack's previous breeding male (1547M). Two pups were born to the previous breeding pair in 2009, and two zoo-born pups were fostered into the wild litter. The breeding pair and two of the pups were captured and radio-collared in December.

Pocosin Lakes Pack (2 collared wolves)

The Pocosin Lakes pack consists of a radio-collared breeding pair (1301M, 1358F). Four pups were born in 2009.

Beech Ridge Pack (3 collared wolves)

The Beech Ridge pack consists of radio-collared siblings, an adult female (1429F) and two yearlings (1693F, 1698M). The breeding male (1199M) was killed in December when struck by a vehicle. The breeding female (1162F) was killed in 2008 when apparently struck by a vehicle.

South Railroad Pack (0 collared canids)

The radio-collared female (1436F) was found dead in December. Her mortality appears to be the result of gunshot. A resident male coyote also was killed by gunshot in November.

Shirley Pack (1 collared wolf)

The Shirley pack consists of the radio-collared breeding male (1504M). His mate (1430F) died of unknown causes earlier in the year. Four pups were born in 2009.

Mannings Pack (1 collared wolf)

The Mannings pack consists of a radio-collared male (1469M). His mate (1668F) was found dead during the summer of 2009, but the cause of death could not be determined.

L-Block Pack (2 collared wolves)

The L-Block pack consists of a radio-collared breeding pair (1238M, 1539F). This pair was formed earlier in 2009 when biologists removed a sterile female coyote that had been paired with the male wolf. The female wolf was held in a soft-release acclimation pen within the territory; the two wolves pair bonded upon her release.

F2 Pack (1 collared wolf)

The only known radio-collared member of the F2 pack is a female (1577F).

Parker Tract Pack (1 collared coyote)

The radio-collared female wolf (1268F) was found dead in October. Her mortality appears to be the result of gunshot. A radio-collared sterile male coyote remains in the territory.

Scuppernong Pack (1 collared wolf, 1 collared coyote)

The Scuppernong pack consists of a radio-collared male wolf (1683M) and a sterile radio-collared female coyote. This pair bonded when the male dispersed from the Swindell pack earlier in 2009, and likely displaced the resident sterile male coyote.

Tyson Pack (8 collared wolves)

The Tyson pack consists of the radio-collared breeding pair (1519M, 1448F), three radio-collared yearlings (1678F, 1681M, 1682M), and three pups (1758F, 1760M, 1761M) that were captured and collared in late November. A fourth pup has not yet been captured. The breeding pair was captured and released in late December after their radio-collars were replaced.

Northern Pack (2 collared wolves)

The Northern pack consists of a radio-collared breeding pair (1628M, 1470F). This is a relatively new pack, formed when the male (1628M) dispersed from the Columbia pack earlier in 2009 and displaced the resident sterile male coyote.

Gumneck Pack (2 collared wolves)

The Gumneck pack consists of a radio-collared breeding pair (1516M, 1685F). This pack formed in December after biologists removed a female coyote that was paired with the male wolf. The female wolf (1685F) had dispersed from the Swindell pack earlier in 2009 and was in the Gumneck area prior to the coyote's removal.

Frying Pan Pack (4 collared wolves)

The Frying Pan pack consists of the radio-collared breeding male (1177M) and three of his radio-collared offspring, an adult male (1533M), a yearling female (1686F), and a female pup (1772F). The yearling and pup were captured, radio-collared, and released in December. The breeding female (1132F) was found dead earlier this year of unknown causes. Three additional pups were born in 2009. Two of the pups were killed when struck by a vehicle earlier in 2009; the status of the third is unknown.

Timberlake Pack (2 collared wolves)

The Timberlake pack consists of a radio-collared breeding pair (1452M and 1300F).

Columbia Pack (1 collared wolf, 1 collared coyote)

The Columbia pack consists of a radio-collared male (1458M), who was captured in October and fitted with a new collar, and a sterile radio-collared female coyote. The breeding female wolf (1163F) was found dead of an unknown cause earlier in 2009.

Highway 64 Pack (0 collared canids)

There are no known current members of the Highway 64 pack. The radio-collared breeding female (1665F) was killed by gunshot in November.

Collaborations

Research

The Red Wolf Recovery Program provided financial and in-kind support for collaborative research with scientists at other institutions, including universities, interagency divisions, and non-government research organizations. These investigations required project staff to assist outside researchers and graduate students in their efforts to better understand red wolf ecology, ecosystem function, and conservation efforts.

Project Title: Wild canid genetic sampling in Eastern North Carolina.
Graduate Student: Justin Bohling (PhD student)
Committee Chair/Principal Investigator: Lisette Waits, PhD, University of Idaho

Project Title: The effects of parenthood on red wolves (*Canis rufus*) in northeastern North Carolina.
Graduate Student: Justin Dellinger (MS student)
Committee Chair/Principal Investigator: Troy Best, PhD, Auburn University

Project Title: Identifying management procedures to reduce red wolf-coyote interactions in eastern North Carolina.
Graduate Student: Joseph Hinton (PhD student)
Committee Chair/Principal Investigator: Michael Chamberlain, PhD, Louisiana State University

Project Title: An assessment of spatial and temporal activities of wild adult male red wolves using GPS telemetry.
Graduate Student: Melissa Karlin (PhD student)
Committee Chair/Principal Investigator: John Chadwick, PhD, University of North Carolina at Charlotte

Project Title: Seasonal Cycles in Red Wolf Home Range Characteristics: A GPS Collar and Multispectral Satellite Image Study.
Graduate Student: Melissa Karlin (PhD student)
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Graduate Student: Justin McVey (MS student)
Committee Chair/Principal Investigator: Chris Moorman, PhD, North Carolina State University

Project Title: Evaluating potential effects of widening US Highway 64 on red wolves, Washington, Tyrrell, and Dare Counties, North Carolina.
Graduate Student: Christine Proctor (PhD student)
Committee Chair/Principal Investigator: Michael R. Vaughan, PhD, Virginia Polytechnic Institute and State University (Virginia Tech)

Project Title: Genetic variability and evolutionary relationships of the red wolf.
Graduate Student: n/a
Committee Chair/Principal Investigator: Lisette Waits, PhD, University of Idaho

Publications

The following publications have gone to print in this quarter. A complete list of publications related to red wolves can be found at http://www.fws.gov/redwolf/biblio.html.

Beck, K.B., C.F. Lucash, and M.K. Stoskopf. 2009. Lack of impact of den interference on neonatal red wolves. Southeastern Naturalist 8(4):631-638.

Moresco, A., L. Munson, and I.A. Gardner. 2009. Naturally occurring and melengestrol acetate-associated reproductive tract lesions in zoo canids. Veterinary Pathology 46(6):1117-1128. [Abstract available at http://www.ncbi.nlm.nih.gov/pubmed/19605907]

Presentations

The following presentations related to red wolves were given during this quarter.

Bohling, J.H., A. Beyer, and L.P. Waits. 2009. Factors influencing red wolf-coyote hybridization in eastern North Carolina. Program and Book of Abstracts. Carnivores 2009, November 15-18, Denver, CO. [Abstract available at http://www.defenders.org/resources/publications/programs_and_policy/wildlife_conservation/imperiled_species/wolf/carnivores_conference_2009.pdf]

Karlin, M. 2009. An assessment of spatial and temporal behaviors of adult male red wolves using GPS collars. Program and Book of Abstracts. Carnivores 2009, November 15-18, Denver, CO. [Abstract available at http://www.defenders.org/resources/publications/programs_and_policy/wildlife_conservation/imperiled_species/wolf/carnivores_conference_2009.pdf]

Kroeger, T. 2009. Economic benefits provided by red wolf habitat in North Carolina. Program and Book of Abstracts. Carnivores 2009, November 15-18, Denver, CO. [Abstract available at http://www.defenders.org/resources/publications/programs_and_policy/wildlife_conservation/imperiled_species/wolf/carnivores_conference_2009.pdf]

Mahoney, P., T.D. Steury, and D.L. Murray. 2009. A re-assessment of red wolf viability using stage-structured, stochastic models. Program and Book of Abstracts. Carnivores 2009, November 15-18, Denver, CO. [Abstract available at http://www.defenders.org/resources/publications/programs_and_policy/wildlife_conservation/imperiled_species/wolf/carnivores_conference_2009.pdf]

Steury, T., K. Beck, A.B. Beyer, and D.L. Murray. 2009. Can large carnivores persist in human-dominated landscapes? The case of the red wolf. Program and Book of Abstracts. Carnivores 2009, November 15-18, Denver, CO. [Abstract available at http://www.defenders.org/resources/publications/programs_and_policy/wildlife_conservation/imperiled_species/wolf/carnivores_conference_2009.pdf]

Waits, L. 2009. Molecular genetic contributions to noninvasive survey approaches for carnivores. Program and Book of Abstracts. Carnivores 2009, November 15-18, Denver, CO. [Abstract available at http://www.defenders.org/resources/publications/programs_and_policy/wildlife_conservation/imperiled_species/wolf/carnivores_conference_2009.pdf]

Wheeler, K. 2009. The face of red wolf conservation today. Program and Book of Abstracts. Carnivores 2009, November 15-18, Denver, CO. [Abstract available at http://www.defenders.org/resources/publications/programs_and_policy/wildlife_conservation/imperiled_species/wolf/carnivores_conference_2009.pdf]

Staff and Volunteers

The Red Wolf Recovery Program employs eight full-time staff, including the program coordinator, four wildlife biologists, a biological technician, an outreach coordinator, and an administrative assistant. During the quarter being reported the outreach coordinator and administrative assistant positions were vacated. The Red Wolf Recovery Program also employs an intern.

Outreach

Staff from the Red Wolf Recovery Program conducted numerous presentations and attended several events to inform and educate the public on the conservation needs of the red wolf and the restoration efforts of the Red Wolf Recovery Program. As part of our effort to assist educators, red wolf "discovery boxes" were distributed to 21 educational facilities in Florida, New York, North Carolina, Tennessee, Texas, and Virginia. Discovery boxes include materials about the red wolf and are used to support red wolf education.

The Red Wolf Recovery Program also seeks to achieve a quality visitor and participant experience in the U.S. Fish and Wildlife Service's priority recreational uses on National Wildlife Refuges. Our outreach efforts focus on four of the six program elements, including wildlife observation, wildlife photography,

environmental education, and interpretation, and are conducted frequently in partnership with ARNWR and PLNWR educators and volunteers.

Presentations

Date	Location	Audience	Length	Attendance	Presenter
Nov 13	ARNWR	Duke University & Society for Conservation Biology (Triangle Chap.)	3 hours	20	M. Morse

Howlings

Date	Location	Event	Length	Attend	Presenter
Oct 17	ARNWR	Wolf Awareness Week	2 hrs	45	D. Hendry K. Wheeler
Oct 24	ARNWR	Howl-O-Ween	2 hrs	Rain Out	D. Hendry K. Wheeler
Nov 5	ARNWR	Wings Over Water	2 hrs	20	D. Hendry K. Wheeler
Dec 12	ARNWR	Holiday Howl	2 hrs	43	D. Hendry K. Wheeler

Partnerships

Species Survival Plan (SSP)

Species Survival Plan (SSP) captive facility coordination is based at Point Defiance Zoo & Aquarium (PDZA) in Tacoma, Washington. The SSP currently coordinates 42 captive red wolf sites at zoos and nature centers housing about 120 wolves. The following information is based on activities completed or conducted by the SSP Coordinator during the quarter reported. Additional information on the SSP can be found at www.fws.gov/redwolf or www.pdza.org.

The SSP Coordinator reported completing and distributing the final breeding and transfer recommendations for the captive population, and directly communicating with cooperators to ensure that transfers and recommendations were accomplished. The SSP Coordinator also reported that den locations were identified and additional land clearing had been conducted at the Northwest Trek site. The Northwest Trek will replace the existing Graham facility as the flagship captive-breeding facility at PDZA. The development of Northwest Trek was made possible, in part, from funds from the Omnibus Appropriations Act 2009 (Public Law 111-8 – March 11, 2009), and the efforts of Congressman Norm Dicks (WA) and Congressman Heath Shuler (NC). An additional $179,000 was awarded to the Western North Carolina Nature Center (Asheville, NC) to upgrade their red wolf breeding and holding facilities.

Island Propagation Sites

The U.S. Fish and Wildlife Service utilizes island sites to propagate red wolves and contribute to the restoration of a wild red wolf population, primarily by fostering island-born wolves into the wild population as a means to augment the wild red wolf gene pool with "under-represented" genes from the captive population. Currently, the Red Wolf Recovery Program cooperates with St. Vincent National Wildlife Refuge in maintaining a breeding pair of red wolves on an island site.

Red Wolf Recovery Program

Photo credit: Ryan Nordsven

3rd Quarter Report

April - June 2010

Coordinator: David R. Rabon Jr., PhD
Wildlife Biologists: Art Beyer, Chris Lucash, Ford Mauney, Michael L. Morse
Biological Technician: Ryan Nordsven
Outreach Coordinator: Vacant
Administrative Assistant: Vacant
Intern (Caretaker): David J. (DJ) Sharp

www.fws.gov/redwolf

trackthepack.blogspot.com

The Red Wolf Recovery Program

The red wolf (*Canis rufus*) is one of the most endangered canids in the world. Once occurring throughout the eastern and south-central United States, red wolves were decimated by predator-control programs and the loss and alteration of habitats. By the 1970s, these activities had reduced the red wolf population to a small area along the Gulf coast of Texas and Louisiana. To protect the species from extinction, the U.S. Fish and Wildlife Service initiated efforts to locate and capture as many red wolves as possible for the purposes of establishing a program to breed the species in captivity and one day reintroduce the species into a portion of its former range. More than 400 canids were captured in coastal areas of Texas and Louisiana, but only 17 were identified as pure red wolves. Fourteen of these wolves would become the founding members of the captive-breeding program and the ancestors of all red wolves existing today.

The first litter of red wolves born in captivity occurred in 1977. Within a few years red wolves were successfully reproducing in captivity, allowing the U.S. Fish and Wildlife Service to consider reintroducing the species in the wild. In 1987, four male-female pairs of red wolves were released in Alligator River National Wildlife Refuge (ARNWR) in northeastern North Carolina and designated as an experimental population. Since then, the experimental population has grown and the recovery area expanded to include four national wildlife refuges, a Department of Defense bombing range, state-owned lands, and private lands, encompassing about 1.7 million acres. However, interbreeding with the coyote (a species not native to North Carolina) has been recognized as a threat affecting the restoration of red wolves. Currently, adaptive management efforts are making progress in reducing the threat of coyotes to the red wolf population in northeastern North Carolina. Other threats, such as habitat fragmentation, disease, and premature mortality, are of concern in the restoration of red wolves. Efforts to reduce the threats are presently being explored.

Program Objectives

The current recovery plan (U.S. Fish and Wildlife Service, 1990) specifies the following objectives:

1) Establish and maintain at least three red wolf populations via restoration projects within the historic range of the red wolf. Each population should be numerically large enough to have the potential for allowing natural evolutionary processes to work within the species. This must be paralleled by the cooperation and assistance of at least 30 captive-breeding facilities in the United States.
2) Preserve 80% to 90% of red wolf genetic diversity for 150 years.
3) Remove threats of extinction by achieving a wild population of approximately 220 wolves and a captive population of approximately 330 wolves.
4) Maintain the red wolf into perpetuity through embryo banking and cryogenic preservation of sperm.

The Red Wolf Population

For the purposes of this report, all population figures are comprised only of known canids (i.e., wolves, coyotes, and/or hybrids that are actively monitored through either a functioning radio-collar or surgically implanted abdominal radio transmitter). Additional wolves, coyotes, and/or hybrids may be present, but have not been captured or their presence otherwise confirmed.

Population and Territory Status

A total of 74 known red wolves occupied the Red Wolf Recovery Area (i.e., 1.7 million acres in five counties in northeastern North Carolina) at the end of the third quarter of our fiscal year 2010 (FY 10). The population includes 26 packs (totaling 62 wolves) with 13 breeding pairs. An additional 12 wolves are not known to be associated with a pack (as defined in the Pack Summaries section).

The Red Wolf Recovery Program documented nine litters (totaling 42 pups) born in the Red Wolf Recovery Area during the 2010 whelping season. Additional pups and/or litters could be present, but

have not been confirmed. Two pups born in captivity at Lincoln Park Zoo (Chicago, IL) were fostered into a wild litter (see Pack Summaries section below). Pups born during the 2010 whelping season are not included in the reported population numbers.

Wolf Pairings

One breeding pair (Ventures pack) was lost and one breeding pair (Beech Ridge pack) was formed during the quarter. One additional breeding pair (Northern pack) appears to have been lost, but the status of the breeding female is unresolved (see Pack Summaries section).

Wolf Captures and Radio Telemetry Marking

During this quarter, Red Wolf Recovery Program staff logged approximately 3,632 trap-nights. For that effort, four wolves were captured, two of which were first time captures. All wolves were fitted or re-fitted with radio-collars (either VHF or GPS) and released. Captured wolves consisted of two adults (1 male and 1 female) and two yearlings (1 male and 1 female).

Dispersals

Two known wolves dispersed from their natal territories during the quarter, including a yearling male (1756M) from Waupaupin pack and a yearling male (1777M) from Ventures pack.

Mortalities

Four known wolves (2 adult males, 2 yearling males) from the Red Wolf Recovery Area died during the quarter, including two adult males (1726M and 1185M) that are being investigated by the U.S. Fish and Wildlife Service's Office of Law Enforcement for suspected illegal take (see Announcements section below), one yearling male (1745M) that died from a vehicle collision after dispersing from his natal range (Milltail pack) during the last quarter, and a yearling male (1756M) that died of unknown causes after dispersing from his natal range (Waupaupin pack) during the current quarter.

Disappearances

The Red Wolf Recovery Program lost radio contact with two wolves (1 adult, 1 yearling) during the quarter, including a breeding female wolf (1470F) from Northern pack that disappeared just before whelping season and a yearling male (1777M) from Ventures pack that disappeared after dispersing from his natal territory.

Pack Summaries

For the purposes of this report, the criteria used to define a pack include a known wolf maintaining an established territory and is either associating with or has historically associated with another wild canid inhabiting the same territory. Packs identified in the following summaries include a minimum of one known wolf within the quarter being reported.

Milltail Pack (4 collared wolves)

The Milltail pack consists of the radio-collared breeding pair (1544M male, 1357F female), one radio-collared adult offspring born in 2008 (1660F), and one radio-collared yearling born in 2009 (1743F). A litter of seven pups was born to the breeding pair in April.

Gator Pack (2 collared wolves)

The Gator pack consists of a radio-collared breeding pair (1661M, 1085F).

Lux Pack (0 collared canids)

The radio-collared female wolf (904F) moved out of the territory. No other canid has been captured at Lux pack.

Hester Pack (1 collared wolf, 1 collared coyote)

The Hester pack consists of one radio-collared male wolf (1333M) and one radio-collared sterile female coyote.

Waupaupin Pack (2 collared wolves)

The Waupaupin pack consists of a radio-collared breeding pair (1657M, 1471F). The female was captured, her radio-collar replaced, and released in April. A yearling male (1756M) born in 2009 also was captured, radio-collared, and released in April, but subsequently dispersed from the pack in May. He was found dead of unknown causes in June.

Ventures Pack (4 collared wolves)

The Ventures pack consists of the radio-collared breeding female (1207F), two radio-collared adult offspring (1705M and 1706F) born in 2008, and one radio-collared yearling (1778F) born in 2009. A yearling male (1777M) began to disperse from the pack in March, but was lost to contact in April. The breeding male (1185M) was found dead in April of suspected illegal take. His death is under investigation by the U.S. Fish and Wildlife Service's Office of Law Enforcement. A litter of seven pups was born to the breeding pair in April.

Carmur Pack (1 collared wolf, 1 collared coyote)

The Carmur Pack consists of one radio-collared male wolf (1672M) and one radio-collared sterile female coyote. The radio-collared male wolf (1313M) previously occupying Carmur pack moved out of the territory in April. The current male (1672M) was initially captured, radio-collared, and released in June; he was originally from the Rich pack. The female coyote was captured, radio-collared, sterilized, and released in June.

Swindell Pack (4 collared wolves)

The Swindell pack consists of the radio-collared breeding pair (1540M, 1419F) and two radio-collared yearlings (1749M, 1750M) born in 2009. A litter of four pups was born in April.

Weyerhaeuser Pack (2 collared wolf)

The Weyerhaeuser pack consists of a radio-collared breeding pair (1684M, 1440F). A litter of five pups was born to the breeding pair in April.

Cameron Pack (1 collared coyote)

The Cameron pack consists of a radio-collared sterile female coyote. The male wolf (1726M) was found dead in April of suspected illegal take. His death is under investigation by the U.S. Fish and Wildlife Service's Office of Law Enforcement.

Whitetail Pack (5 collared wolves)

The Whitetail pack consists of the radio-collared breeding female (1298F), one radio-collared adult offspring (1708F) born in 2008, and three radio-collared yearlings (1779F, 1780M, 1781M) born in 2009.

Kilkenny Pack (4 collared wolves)

The Kilkenny pack consists of a radio-collared breeding pair (1547M, 1170F) and two radio-collared yearlings (1766M, 1768M) born in 2009. A litter of two pups was born to the breeding pair in April. Two pups born in captivity at the Lincoln Park Zoo (Chicago, IL) were fostered into the litter in April.

Rich Pack (3 collared wolves)

The Rich pack consists of a radio-collared breeding pair (1703M, 1633F) and one radio-collared yearling (1741F) born in 2009. A litter of four pups was born to the breeding pair in April.

Pocosin Lakes Pack (3 collared wolves)

The Pocosin Lakes pack consists of a radio-collared breeding pair (1301M, 1358F) and one radio-collared yearling (1748M) born in 2009.

Pungo Pack (0 collared canids)

The radio-collared male wolf (1620M) moved out of the Pungo territory during the quarter. No other canid has been captured at Pungo pack.

Beech Ridge Pack (4 collared wolves)

The Beech Ridge pack consists of a radio-collared breeding pair (1105M, 1429F) and two younger adult siblings (1693F, 1698M) of the breeding female. The breeding male moved into the territory prior to this quarter. A litter of four pups was born to the breeding pair in April.

Cutler Pack (2 collared wolves)

The Cutler pack (previously the Bishop pack) consists of a radio-collared breeding pair (1621M, 1671F). This pair relocated their territory from the Bishop pack area to the Cutler pack area during the quarter.

Mannings Pack (1 collared wolf)

The Mannings pack consists of a radio-collared male (1469M). A female coyote was captured and removed from the area during the last quarter, but no other canid has been captured at the Mannings pack area since then.

L-Block Pack (1 collared wolf)

The L-Block pack consists of a radio-collared male wolf (1238M). The radio-collared female wolf (1539F), captured last quarter and held in captivity for medical treatment, was released in April at L-Block. She has remained in the vicinity, but has not established a residence in the L-Block pack territory.

F2 Pack (1 collared wolf, 1 collared coyote)

The F2 pack consists of a radio-collared female wolf (1577F) and a sterile radio-collared male coyote.

Scuppernong Pack (1 collared wolf, 1 collared coyote)

The Scuppernong pack consists of a radio-collared male wolf (1683M) and a sterile radio-collared female coyote.

Tyson Pack (5 collared wolves)

The Tyson pack consists of the radio-collared breeding pair (1519M, 1448F), one radio-collared adult offspring (1682M) born in 2008, and two radio-collared yearlings (1760M, 1761M) born in 2009. A litter of six pups (estimated to have been born in April) was discovered in June.

Northern Pack (1 collared wolf)

The Northern pack consists of a radio-collared breeding male (1628M). Contact was lost with the radio-collared breeding female (1470F) in April, just prior to the whelping season. It is unclear whether her collar malfunctioned or if she is no longer in the area. Although her presence in the area has not been confirmed, a litter of three pups (estimated to have been born in April) was discovered in June.

Gumneck Pack (2 collared wolves)

The Gumneck pack consists of a radio-collared breeding pair (1516M, 1685F).

Buck Ridge Pack (1 collared wolf, 1 collared coyote)

The Buck Ridge pack consists of a radio-collared female wolf (1678F) and a sterile radio-collared male coyote.

Frying Pan Pack (3 collared wolves)

The Frying Pan pack consists of the radio-collared breeding male (1177M) and two radio-collared offspring, including an adult female (1686F) born in 2008 and a yearling female (1772F) born in 2009.

Timberlake Pack (2 collared wolves)

The Timberlake pack consists of a radio-collared breeding pair (1452M, 1300F).

Columbia Pack (2 collared wolves)

The Columbia pack consists of a radio-collared breeding male (1458M) and his radio-collared adult female offspring (1630F) born in 2007. The radio-collared sterile female coyote was killed when struck by a vehicle after likely being displaced from Columbia pack area by the young female wolf.

Little Alligator Pack (1 collared wolf)

The Little Alligator pack consists of a radio-collared male (1727M). An un-collared coyote has been spotted with the male, but attempts to capture the coyote have been unsuccessful.

Collaborations

Research

The Red Wolf Recovery Program provided financial and in-kind support for collaborative research with scientists at other institutions, including universities, interagency divisions, and non-government research organizations. These investigations required project staff to assist outside researchers and graduate students in their efforts to better understand red wolf ecology, ecosystem function, and conservation efforts.

Project Title: Wild canid genetic sampling in Eastern North Carolina.
Graduate Student: Justin Bohling (PhD student)
Committee Chair/Principal Investigator: Lisette Waits, PhD, University of Idaho

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Project Title: Evaluating potential effects of widening US Highway 64 on red wolves, Washington, Tyrrell, and Dare Counties, North Carolina.
Graduate Student: Christine Proctor (PhD student)
Committee Chair/Principal Investigator: Michael R. Vaughan, PhD, Virginia Polytechnic Institute and State University (Virginia Tech)

Publications

The following publications have gone to print in this quarter. A complete list of publications related to red wolves can be found at www.fws.gov/redwolf/biblio.html.

Chadwick, J., B. Fazio, and M. Karlin. 2010. Effectiveness of GPS-based telemetry to determine temporal changes in habitat use and home-range sizes of red wolves. Southeastern Naturalist 9(2):303-316.

Presentations

No presentations related to red wolves were reported during this quarter.

Staff and Volunteers

The Red Wolf Recovery Program employs eight full-time staff, including the program coordinator, four wildlife biologists, a biological technician, an outreach coordinator, and an administrative assistant. The outreach coordinator and administrative assistant positions are currently vacant. The Red Wolf Recovery Program also benefits from an unpaid intern (Caretaker).

Outreach

Staff from the Red Wolf Recovery Program conduct presentations and attend events to inform and educate the public on the conservation needs of the red wolf and the restoration efforts of the Red Wolf Recovery Program. As part of our effort to assist educators, red wolf "discovery boxes" that include materials about the red wolf are distributed to educational facilities upon request.

The Red Wolf Recovery Program also seeks to achieve a quality visitor and participant experience in the U.S. Fish and Wildlife Service's priority recreational uses on National Wildlife Refuges. Our outreach efforts focus on four of the six program elements, including wildlife observation, wildlife photography, environmental education, and interpretation, and are conducted frequently in partnership with ARNWR and PLNWR educators and volunteers.

Presentations

Date	Location	Audience	Length	Attendance	Presenter
April 24	Dare County	Red Wolf Coalition Bailey Wildlife Foundation	3 hrs	10	D. Rabon
April 29	Dare County	Smithsonian Magazine	6 hrs	1	RWRP Staff
May 11	Dare County	United States of Adventure	6 hrs	3	RWRP Staff
June 16	Dare County	USDA NRCS	3 hrs	15	M. Morse
June 17	Dare County	Duke Energy The Nature Conservancy Charlotte Observer	3 hrs	9	D. Rabon
June 22	Dare County	Wildlands Network	2 hrs	2	D. Rabon A. Beyer
June 29	Dare County	Wildlands Network	3 hrs	2	D. Rabon

Howlings

Date	Location	Event	Length	Attend	Presenter
April 24	ARNWR	Earth Day	2 hrs	71	K. Wheeler D.J. Sharp
June 9	ARNWR	Summer Howling	2 hrs	43	K. Wheeler D.J. Sharp
June 16	ARNWR	Summer Howling	Cancelled - Weather	0	K. Wheeler D.J. Sharp
June 23	ARNWR	Summer Howling	2 hrs	41	K. Wheeler D.J. Sharp
June 30	ARNWR	Summer Howling	Cancelled - Weather	0	K. Wheeler D.J. Sharp

Website / Social Media

The Red Wolf Recovery Program recently launched a weblog to provide a fun and creative outlet that highlights the efforts of the Red Wolf Recovery Program staff in the conservation of the red wolf. The weblog combines text, images, videos, and links to other media related to its topic. The content includes educational, informational, and general journal entries written by program staff, and allows readers to leave comments in an interactive format. The weblog can be found at trackthepack.blogspot.com.

Media Inquires

The Red Wolf Recovery Program responded to numerous media inquiries during this quarter, including Smithsonian Magazine (article entitled "Buying time" in the August 2010, 40th Anniversary Edition, available on-line at www.smithsonianmag.com/specialsections/40th-anniversary/Rising-Seas-Endanger-Wetland-Wildlife.html?c=y&page=1); Batwin & Robin Productions (media productions for The Daily Planet and the North Carolina Museum of Natural Sciences); The Charlotte Observer; and, science writer DeLene Beeland (www.delene.us), who is writing a new book about red wolves.

Partnerships

Species Survival Plan (SSP)

Species Survival Plan (SSP) captive facility coordination is based at Point Defiance Zoo & Aquarium (PDZA) in Tacoma, Washington. The SSP currently coordinates 42 captive red wolf sites at zoos and nature centers housing about 179 wolves. The following information is based on activities completed or conducted by the SSP Coordinator during the quarter reported. Additional information on the SSP can be found at www.fws.gov/redwolf or www.pdza.org.

The SSP Coordinator reported eight confirmed pregnancies in the SSP population. Two litters did not result in live-births; one required the C-section of a single pup that was dead in-utero, and one was still-born with the number and sexes of pups unknown. The remaining six litters resulted in 24 pups with 11 surviving in the SSP population to date. Two of the 24 pups were cross-fostered from a litter of nine pups born at Lincoln Park Zoo (Chicago, IL) to a wild litter of the Kilkenny pack (see Pack Summaries). Many thanks to Lincoln Park Zoo and the red wolf field crew for their efforts to make this happen.

The SSP Coordinator also noted that progress continues on construction of the new off-site facility located adjacent to Northwest Trek Wildlife Park. A very wet spring has resulted in some minor construction delays and pushed back their ability to begin moving wolves by the anticipated date as reported last quarter. In addition, a follow-up program was presented in May to the Clear Lake Homeowners Association (within howling distance of site) to keep residents informed about the relocation work and to answer questions. About 50 individuals attended. Follow-up meetings are planned to keep residents informed. [The Northwest Trek facility will replace the existing Graham facility as the flagship captive-breeding facility at PDZA. The development of Northwest Trek was made possible, in part, with funds from the Omnibus Appropriations Act 2009 (Public Law 111-8 – March 11, 2009), and the efforts of Congressman Norm Dicks (WA) and Congressman Heath Shuler (NC). An additional $179,000 was awarded to the Western North Carolina Nature Center (Asheville, NC) to upgrade their red wolf breeding and holding facilities.]

The SSP Coordinator also reported that the Trevor Zoo (Millbrook, NY) is supporting the educational goals of the 2010 International Year of Biodiversity with an informative exhibit that defines biodiversity and explains its value while also describing some of the threats to biodiversity. This exhibit focuses on the great work of the SSPs for the red panda and the red wolf, and focuses especially on the success stories and progress made in securing more wildlife habitat for the red panda and in the careful management and increasing numbers of the red wolf. Kelly Fallon, a senior student in environmental science at Millbrook School, created this exhibit as an independent study project with help from Trevor

Zoo Conservation Education Director, Jane H. Meigs. The hope is that visitors to the Trevor Zoo and students at Millbrook School will understand the crucial role of zoos in conserving biodiversity both in the field and at zoo facilities.

Lastly, the SSP Coordinator reported a new cooperative effort with the American Zoo and Aquarium Association's (AZA) Wildlife Contraception Center (WCC) and the Canid Taxon Advisory Group to provide the WCC with medical/pathology reports of red wolves for analysis of reproductive health issues in canids, specifically the incidence of pyometra and endometrial hyperplasia.

Island Propagation Sites

The U.S. Fish and Wildlife Service utilizes island sites to propagate red wolves and contribute to the restoration of a wild red wolf population, primarily by inserting island-born wolves into the wild population as a means to augment the wild red wolf gene pool with "under-represented" genes from the captive population. Currently, the Red Wolf Recovery Program cooperates with St. Vincent National Wildlife Refuge in maintaining a breeding pair of red wolves on an island site.

Red Wolf Coalition (RWC)

The Red Wolf Coalition (RWC) is a non-profit organization based in northeastern North Carolina that advocates for the long term survival of red wolf populations through education and outreach. The RWC's educational program teaches students about the history, biology, and status of the red wolf recovery program, and accompanies students to ARNWR and PLNWR to learn about the habitat of the red wolf. The RWC currently employees an Executive Director, and has a membership of approximately 400 individuals and organizations. The following information is based on activities completed or conducted by the Executive Director during the quarter reported. Additional information on the RWC can be found at www.redwolves.com.

The Executive Director reported the RWC launched a capital campaign to enclose a spacious woodland lot adjacent to the U.S. Fish and Wildlife Service's Red Wolf Education and Health Care Facility in Columbia, NC. The enclosures will offer visitors an opportunity to view "ambassador" red wolves in the only captive facility open to the public located within the Red Wolf Recovery Area. Information on the capital campaign can be found at www.crowdrise.com/enclosure/fundraiser/redwolfcoalition.

The Executive Director of the RWC also reported the start of the summer howling season in June with weekly howlings on Wednesday at 7:30 pm on ARNWR (see Outreach section). Additional information on the howlings can be found at www.redwolves.com. The RWC also is cooperating with PLNWR on their summer science camp.

The Executive Director of the RWC reported that the RWC received grants from Shared Earth Foundation and the UK Wolf Conservation Trust. The RWC extends its gratitude to both organizations for their long-time support of the RWC and red wolf conservation.

Announcements

The U.S. Fish and Wildlife Service is investigating the suspected illegal take of two radio-collared red wolves that were found dead in two different locations in Hyde County, North Carolina. The first wolf was located on April 23, 2010, near Englehard. The second wolf was located on April 27, 2010, near Scranton. Contributions from the following organizations and individuals have increased the amount of a reward of up to $15,000 for information directly leading to an arrest, a criminal conviction, a civil penalty assessment, or forfeiture of property on the subject or subjects responsible for the suspected unlawful take of these red wolves:

- Red Wolf Coalition
- Defenders of Wildlife

- Humane Society of the United States and the Humane Society Wildlife Land Trust
- Cathy Kangas, Humane Society National Council member
- North Carolina Wildlife Federation

The red wolf is protected under the Endangered Species Act. The maximum criminal penalties for the unlawful taking of a red wolf are one year imprisonment and $100,000 fine per individual. Anyone with information on the deaths of these red wolves or any others, past or future, is urged to contact Special Agent Sandra Allred at (919) 856-4786, Refuge Officer Chris Smith at (252) 926-4021, or North Carolina Wildlife Resources Commission Officer Robert Wayne at (252) 216-8225.

Red Wolf Recovery Program

Photo credit: Ryan Nordsven/USFWS

3rd Quarter Report

April – June 2012

Coordinator: David R. Rabon Jr., PhD
Wildlife Biologists: Art Beyer, Chris Lucash, Ford Mauney, Michael L. Morse
Biological Technician: Ryan Nordsven
Public Affairs and Outreach Coordinator: Vacant
Administrative Assistant: Vacant
Intern (Caretaker): Alayna McGarry / Kyla Brick

www.fws.gov/redwolf

trackthepack.blogspot.com

www.facebook.com/redwolfrecoveryprogram

The Red Wolf Recovery Program

The red wolf (*Canis rufus*) is one of the most endangered canids in the world. Once occurring throughout the eastern and south-central United States, red wolves were decimated by predator-control programs and the loss and alteration of habitats. By the 1970s, these activities had reduced the red wolf population to a small area along the Gulf coast of Texas and Louisiana. To protect the species from extinction, the U.S. Fish and Wildlife Service initiated efforts to locate and capture as many red wolves as possible for the purposes of establishing a program to breed the species in captivity and one day reintroduce the species into a portion of its former range. More than 400 canids were captured in coastal areas of Texas and Louisiana, but only 17 were identified as pure red wolves. Fourteen of these wolves would become the founding members of the captive-breeding program and the ancestors of all red wolves existing today.

The first litter of red wolves born in captivity occurred in 1977. Within a few years red wolves were successfully reproducing in captivity, allowing the U.S. Fish and Wildlife Service to consider reintroducing the species in the wild. In 1987, four male-female pairs of red wolves were released in Alligator River National Wildlife Refuge (ARNWR) in northeastern North Carolina and designated as an experimental population. Since then, the experimental population has grown and the recovery area expanded to include four national wildlife refuges, a Department of Defense bombing range, state-owned lands, and private lands, encompassing about 1.7 million acres.

Adaptive Management

The recovery and restoration of red wolves requires the careful management of eastern coyotes (*C. latrans* var.) and occasionally wolf-coyote hybrids in the red wolf recovery area. The non-native coyotes spread across North Carolina to the red wolf recovery area in the early to mid-1990s. It soon was recognized that interbreeding between red wolves and eastern coyotes would produce hybrid offspring resulting in coyote gene introgression into the wild red wolf population, and that this introgression would threaten the restoration of red wolves. An adaptive management plan was developed to reduce interbreeding and introgression while simultaneously building the red wolf population. The adaptive management plan effectively uses techniques to capture and sterilize hormonally intact coyotes via vasectomy or tubal ligation, then releases the sterile canid at its place of capture to act as a territorial "placeholder" until the animal is replaced by wild red wolves. Sterile coyotes are not capable of breeding with other coyotes, effectively limiting the growth of the coyote population, nor are they capable of interbreeding with wild red wolves, limiting hybridization events. In addition, the sterile canid will exclude other coyotes from its territory. Ultimately, the placeholder canids are replaced by the larger red wolves either naturally by displacing the coyote or via management actions (e.g., removal of the coyote followed by insertion of wild or translocated wolves). Coyotes that are captured on private property are euthanized at the landowner's request.

Currently, adaptive management efforts are making progress in reducing the threat of coyotes to the red wolf population in northeastern North Carolina. Other threats, such as habitat fragmentation, disease, and anthropogenic mortality, also are of concern in the restoration of red wolves. Efforts to reduce these threats are presently being explored.

Program Objectives

The current recovery plan (U.S. Fish and Wildlife Service, 1990) specifies the following objectives:

1) Establish and maintain at least three red wolf populations via restoration projects within the historic range of the red wolf. Each population should be numerically large enough to have the potential for allowing natural evolutionary processes to work within the species. This must be paralleled by the cooperation and assistance of at least 30 captive-breeding facilities in the United States.
2) Preserve 80% to 90% of red wolf genetic diversity for 150 years.
3) Remove threats of extinction by achieving a wild population of approximately 220 wolves and a captive population of approximately 330 wolves.

4) Maintain the red wolf into perpetuity through embryo banking and cryogenic preservation of sperm.

The Red Wolf Population

We estimate between 100 and 120 red wolves in the Red Wolf Recovery Area, but for the purposes of this report all population figures are comprised only of known canids (i.e., those that are regularly monitored through either a functioning radio-collar or surgically implanted abdominal radio transmitter). Additional wolves are likely present, but have not been captured/radio-collared or their continued presence otherwise confirmed.

Beginning with the first quarter of the fiscal year 2012 (FY12) we have changed the way we report population and pack numbers. This change more accurately represents the managed population of canids that are part of our efforts to restore red wolves. The managed population includes wolf packs (i.e., packs consisting entirely of wolves) and mixed packs (i.e., packs of a wolf and coyote pair). A pack is defined as at least two known canids cooperatively inhabiting an established territory.

Population and Territory Status

A total of 75 known red wolves occupied the Red Wolf Recovery Area (i.e., 1.7 million acres in five counties in northeastern North Carolina) at the end of the third quarter of our fiscal year 2012 (FY 12). The population includes 15 wolf packs (comprised of 51 wolves and 13 breeding pairs), and 8 mixed packs (comprised of 8 wolves and 8 coyotes). An additional 16 wolves are not known to be associated with a pack. A total of 52 sterile coyotes were monitored in the Red Wolf Recovery Area at the end of this quarter.

The Red Wolf Recovery Program documented nine red wolf litters (comprised of 40 pups) born in the Red Wolf Recovery Area during the 2012 whelping season. Additional pups and/or litters could be present, but have not been confirmed. Two pups born in captivity at Alligator River National Wildlife Refuge were fostered into a wild litter. Pups born during the 2012 whelping season are not included in the reported population numbers.

Pairings

One breeding pair of red wolves was lost and one pair was formed during the quarter. The breeding pair loss happened when the pair appeared to have been pushed out of their home range by a neighboring wolf pack. The wolf pair that formed was the result of management actions that included the removal of a resident female coyote, followed by holding the resident male wolf with a dispersing female wolf (from another pack) in an acclimation pen for a period of time. Upon their release in April, the pair formed a pair bond and stayed together.

Two mixed pairs (wolf-coyote) were lost during the quarter when program biologists lost contact with two coyotes (1 male, 1 female) that had previously formed pair bonds with resident wolves within their respective territories.

Captures and Radio Telemetry Marking

No red wolves were captured during the quarter.

Two captured female coyotes were sterilized, radio-collared, and released during the quarter.

Dispersals and Displacements

No known red wolf or coyote dispersals or displacements occurred during the quarter.

Mortalities

Two juvenile female red wolves from the Red Wolf Recovery Area are known to have died during the quarter. The mortality of one of the female wolves is suspected to have been the result of illegal take. The cause of mortality of the second wolf is unknown.

Four sterile, radio-collared coyotes (3 males, 1 female) also were known to have died during the quarter. Three of the deaths were the result of vehicle collision, and the fourth cause of mortality is unknown.

Disappearances

The Red Wolf Recovery Program lost radio contact with four coyotes (1 male, 3 females) during the quarter.

Pack Summaries

The Pack Summaries *section has been indefinitely discontinued due to recent events and current circumstances involving the apparent illegal take of red wolves within the Red Wolf Recovery Area.*

Collaborations

Research

The Red Wolf Recovery Program provided financial and in-kind support for collaborative research with scientists at other institutions, including universities, interagency divisions, and non-government research organizations. These investigations required project staff to assist outside researchers and graduate students in their efforts to better understand red wolf ecology, ecosystem function, and conservation efforts.

Project Title: Inbreeding and mate choice in wild red wolves.
Graduate Student: Kristin Brzeski (PhD student)
Committee Chair/Principal Investigator: Sabrina Taylor, PhD, Louisiana State University

Project Title: Identifying management procedures to reduce red wolf-coyote interactions in eastern North Carolina.
Graduate Student: Joseph Hinton (PhD student)
Committee Chair/Principal Investigator: Michael Chamberlain, PhD, University of Georgia

Project Title: Use of stable isotope analysis to elucidate predation patterns of sympatric canids.
Graduate Student: Anne-Marie Hodge (MS student)
Committee Chair/Principal Investigator: Brian Arbogast, PhD, University of North Carolina at Wilmington

Project Title: Evaluating potential effects of widening US Highway 64 on red wolves, Washington, Tyrrell, and Dare Counties, North Carolina.
Graduate Student: Christine Proctor (PhD student)
Committee Chair/Principal Investigator: Michael R. Vaughan, PhD, Virginia Polytechnic Institute and State University (Virginia Tech)

Project Title: Sperm morphology and motility of the red wolf (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigators: Albrecht Schulte-Hostedde, PhD, Laurentian University, and Gabriela Mastromonaco, PhD, Toronto Zoo

Publications

The following publications have gone to print in this quarter. A complete list of publications related to red wolves can be found at http://www.fws.gov/redwolf/biblio.html.

Mittelstadt, J.M. 2012. North Carolina Nights: Endangered red wolves threatened by proposed coyote hunting rule. Reesenews.org. [Available online at http://vimeo.com/40360924 or http://www.youtube.com/watch?v=HOUjQSolpLI].

Sparkman, A.M., J.R. Adams, T.D. Steury, L.P. Waits, D.L. Murray. 2012. Evidence for a genetic basis for delayed dispersal in a cooperatively breeding canid. Animal Behaviour 83:1091-1098.

Presentations

Mittelstadt, J.M. 2012. Reporting on and understanding stakeholders in human/wildlife conflict. College of Veterinary Medicine Seminar, North Carolina State University, April 23, Raleigh, North Carolina.

Rabon, D.R., Jr. 2012. Red wolf recovery in the Albemarle-Pamlico Region. Albemarle-Pamlico National Estuary Program's Science and Technical Advisory Committee Meeting, April 25, Raleigh, North Carolina.

Staff and Volunteers

The Red Wolf Recovery Program employs eight full-time staff, including the program coordinator, four wildlife biologists, a biological technician, a public affairs/outreach coordinator, and an administrative assistant. The public affairs/outreach coordinator and administrative assistant positions are currently vacant. The Red Wolf Recovery Program also benefits from an unpaid intern (Caretaker).

Outreach

Staff from the Red Wolf Recovery Program conduct presentations and attend events to inform and educate the public on the conservation needs of the red wolf and the restoration efforts of the Red Wolf Recovery Program. As part of our effort to assist educators, red wolf "discovery boxes" that include materials about the red wolf are distributed to educational facilities. The distribution of discovery boxes is managed by the Red Wolf Coalition (see Partnerships). Requests for discovery boxes should be made to kwheeler@redwolves.com.

The Red Wolf Recovery Program also seeks to achieve a quality visitor and participant experience in the U.S. Fish and Wildlife Service's priority recreational uses on National Wildlife Refuges. Our outreach efforts focus on four of the six program elements, including wildlife observation, wildlife photography, environmental education, and interpretation, and are conducted frequently in partnership with ARNWR and PLNWR educators and volunteers.

Presentations

Date	Location	Audience	Length	Attendance	Presenter
June 28	Hyde Co.	Hyde County 4-H Summer Camp	2 hrs	90	C. Heffley K. Brick A. Early

Howlings

Date	Location	Event	Length	Attend	Presenter
April 21	ARNWR	Earth Day Howling	2 hrs	67	A. McGarry R. Marchand
May 26	ARNWR	Memorial Day Howling	2 hrs	59	C. Heffley K. Brick
June 6	ARNWR	Summer Howling	2 hrs	64	C. Heffley K. Brick A. Early
June 13	ARNWR	Summer Howling	2 hrs	85	K. Brick C. Stone
June 20	ARNWR	Summer Howling	2 hrs	86	K. Brick I. Heine
June 27	ARNWR	Summer Howling	2 hrs	62	K. Brick J. Cooley

Website / Social Media

Information on the red wolf and the Red Wolf Recovery Program can be found on our website at www.fws.gov/redwolf.

The Red Wolf Recovery Program also maintains several social media sites. Our Facebook page (www.facebook.com/redwolfrecoveryprogram) connects our program with "friends" from around the world and informs them of the conservation efforts of the Red Wolf Recovery Program. Using Twitter, the Red Wolf Recovery Program connects with our "followers" by providing real-time information about all things red wolf. Follow us on Twitter at www.twitter.com/redwolfrecovery. Users can view and download high resolution pictures related to red wolves and the Red Wolf Recovery Program on our Flickr page (www.flickr.com/photos/trackthepack). Lastly, discover, watch, and share videos on red wolves on our YouTube site (www.youtube.com/trackthepacktube).

The Red Wolf Recovery Program also has a weblog that highlights the efforts of the Red Wolf Recovery Program staff in the conservation of the red wolf. The weblog combines text, images, videos, and links to other media related to its topic. The content includes educational, informational, and general journal entries written by program staff, and allows readers to leave comments in an interactive format. The weblog can be found at trackthepack.blogspot.com.

Media Inquires

The Red Wolf Recovery Program responded to numerous media inquiries during this quarter, including science writer DeLene Beeland (www.delene.us), who is writing a book about red wolves, and Jeffrey Mittelstadt (www.jeffmittelstadt.com), a graduate student from the University of North Carolina at Chapel Hill's School of Journalism, who is producing a number of video and mixed-media projects on red wolf restoration. Publications by these authors can be found reposted on our Facebook page and blog.

Partnerships

Species Survival Plan (SSP)

Species Survival Plan (SSP) captive facility coordination is based at Point Defiance Zoo & Aquarium (PDZA) in Tacoma, Washington. The SSP currently coordinates 41 captive red wolf sites at zoos and nature centers housing about 166 wolves. Nine red wolf litters (comprised of 41 pups) were born in SSP cooperating facilities during the 2012 whelping season. Two pups born in captivity at Alligator River National Wildlife Refuge were fostered into a wild litter. Pups born during the 2012 whelping season are not included in the reported captive population numbers. The following information is based on activities completed or conducted by the SSP Coordinator during the quarter reported. Additional information on the SSP can be found at redwolfssp.org.

The SSP Coordinator reported numerous correspondence and communications regarding red wolves, including coordinating the transfer of wolves to accommodate SSP institutional requests; providing vaccination and anesthesia protocols; providing information, specifications and photos on SSP approved fencing to house red wolves; a request from AZA to review a CEF proposal to investigate secondary rodenticide exposure in free-ranging red wolves; and, responding to general requests from national and international students and researchers on the status of red wolves. The SSP Coordinator assisted PhD student (LSU), Kristin Brzeski, with SPARKS output data for analysis in PMx software associated with her project entitled "Inbreeding and mate choice in wild red wolves." The SSP Coordinator also had preliminary communications with founders of Zoo Borns, a website and book series highlighting baby animals, about a new television series showcasing various in situ/ex situ conservation programs and their interest in focusing on the Red Wolf Recovery Program.

The SSP Coordinator received an application for participation in the SSP from Charles Towne Landing State Historic Site (Charleston, SC); the application was approved after review and inspection by SSP management group. The SSP Coordinator also received a request from Ecotarium Museum of Science and Nature (Worcester, MA) about possible interest in SSP participation.

The SSP Coordinator coauthored, with the Recovery Coordinator, an invited article submitted to the World Association of Zoos and Aquariums' WAZA magazine. The special edition will focus on a number of examples of interactive ex situ and in situ population management and the unique contribution zoos and aquaria have made to prevent animal extinction.

The SSP Coordinator, after a lengthy and time-consuming process, received a USFWS export permit to provide additional semen samples for study (Laurentian University and Toronto Metro Zoo) to evaluate the effects of inbreeding on several sperm morphology parameters. The SSP Coordinator also completed reproductive ultrasound examinations on female wolves in conjunction with a study being conducted by Kadie Anderson, DVM, PDZA Intern Veterinarian, to evaluate the prevalence of cystic endometrial hyperplasia in a subset of the SSP population of red wolves. Preliminary results will be presented by Dr. Anderson at July planning meeting at the NC Zoo (Asheboro, NC). Written results will be available when project is completed.

Island Propagation Sites

The U.S. Fish and Wildlife Service utilizes island sites to propagate red wolves and contribute to the restoration of a wild red wolf population, primarily by inserting island-born wolves into the wild population as a means to augment the wild red wolf gene pool with "under-represented" genes from the captive population. Currently, the Red Wolf Recovery Program cooperates with St. Vincent National Wildlife Refuge in maintaining a breeding pair of red wolves on an island site.

Red Wolf Coalition

The Red Wolf Coalition (RWC), a not-for-profit education organization based in Columbia, NC, advocates for the long term survival of wild red wolf populations by teaching about red wolves and by engaging the public in red wolf conservation. The RWC's web site (www.redwolves.com) provides information about the history, biology, and ecology of red wolves, as well as news about red wolf restoration. The RWC

gives red wolf programs to school groups, professional organizations, university students, and other groups. The RWC also conducts workshops for teachers and non-formal educators, including people seeking certification in environmental education.

The RWC reported that construction of the red wolf viewing facility and perimeter fencing at PLNWR in Columbia, NC is completed. The RWC obtained the necessary funds for the red wolf viewing facility from the U.S. Department of Agriculture's Rural Development and from a generous gift from the North Carolina Zoological Society. The red wolf viewing facility will include several enclosures to house red wolves, including a natural environment enclosure designed to showcase red wolves to the visiting public. The facility is scheduled to open in late October 2012.

The RWC and NC Museum of Life and Science (Durham, NC) are co-sponsoring the "Wolves and Wild Lands in the 21st Century" exhibit which opened to the public at the museum in April. The exhibit highlights wolves and their struggle to survive, the cultural and economic pressures which continue to shape their existence, and the challenges that wolves and people face coexisting in the same place. This visually captivating exhibit features six canid specimens - five wolves and a coyote. Information about the exhibit can be found at http://www.ncmls.org/visit/events/wolves-wild-lands.

The RWC Executive Director reported conducting several education programs during the quarter, including an all-day teacher's workshop for the Far Traveler's curriculum to 20 traditional and nontraditional teachers at the North Carolina Life and Science Museum (Durham, NC) and a presentation on environmental education to a group of children from Fayetteville, NC. The RWC Executive Director also reported that the Oak Ridge Elementary School 4th graders held a fundraising for their 5th honorary red wolf adoption. The RWC and the Red Wolf Recovery Program are grateful for the hard work and enthusiasm to red wolf conservation shown by these amazing 4th grade students and teachers.

The RWC also has three Red Wolf Discovery Boxes for all grade levels. These boxes are filled with a variety of hands-on items, activities and artifacts that help students explore the world of red wolves. The red wolf curriculum *Far Traveler* and a variety of books and other resources also are included. Contact Kim Wheeler at 252-796-5600 or kwheeler@redwolves.com for more information or to reserve your Red Wolf Discovery Box.

Announcements

Kristin Brzeski, a PhD student at Louisiana State University, received an American Society of Mammalogists Grant-in-Aid award for $1500. Her proposal, entitled "Examining genetic variation in pre-Columbian red wolves (*Canis rufus*)," was ranked 5th out of 74 submitted grant proposals. Congratulations Kristin!

Jeffrey Mittelstadt successfully defended his thesis and completed his M.A. degree in Technology and Communication in the School of Journalism and Mass Communication at the University of North Carolina at Chapel Hill. Jeff's thesis is entitled "Wildsides business plan," and details the creation of a not-for-profit organization that develops interactive, dynamic, and internet-based documentaries about human-wildlife conflicts. Information on Wildsides can be found at www.wildsides.org. Penny Abernathy, MBA, MS, served as Jeff's advisor and Committee Chair. Congratulations Jeff!

The U.S. Fish and Wildlife Service is investigating the suspected illegal take of several red wolves found dead in the Red Wolf Recovery Area (Dare, Hyde, Tyrrell, Washington, and Beaufort Counties, NC). Contributions from various organizations and individuals have resulted in a reward of up to $15,000 for information directly leading to an arrest, a criminal conviction, a civil penalty assessment, or forfeiture of property on the subject or subjects responsible for the suspected unlawful take of these red wolves. The red wolf is protected under the Endangered Species Act. The maximum criminal penalties for the unlawful taking of a red wolf are one year imprisonment and $100,000 fine per individual. Anyone with information on the deaths of red wolves is urged to contact Special Agent Sandra Allred at (919) 856-4786 or North Carolina Wildlife Resources Commission Officer Robert Wayne at (252) 216-8225.

Red Wolf Recovery Program

Red wolf pups, Red Wolf Recovery Area; Photo credit: A. Beyer/USFWS

3rd Quarter Report

April – June 2013

Coordinator: David R. Rabon Jr., PhD
Assistant Coordinator: Becky Bartel, PhD
Field Coordinator: Art Beyer
Wildlife Biologists: Chris Lucash, Ford Mauney, Michael L. Morse
Biological Technician: Ryan Nordsven
Administrative Assistant: Adam Fauth
Intern(s) (Caretaker): Chelsea Vosburgh / Lizzie Baxter

www.fws.gov/redwolf

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The Red Wolf Recovery Program

The red wolf (*Canis rufus*) is one of the most endangered canids in the world. Once occurring throughout the eastern and south-central United States, red wolves were decimated by predator-control programs and the loss and alteration of habitats. By the 1970s, these activities had reduced the red wolf population to a small area along the Gulf coast of Texas and Louisiana. To protect the species from extinction, the U.S. Fish and Wildlife Service initiated efforts to locate and capture as many red wolves as possible for the purposes of establishing a program to breed the species in captivity and one day reintroduce the species into a portion of its former range. More than 400 canids were captured in coastal areas of Texas and Louisiana, but only 17 were identified as pure red wolves. Fourteen of these wolves would become the founding members of the captive-breeding program and the ancestors of all red wolves existing today.

The first litter of red wolves born in captivity occurred in 1977. Within a few years red wolves were successfully reproducing in captivity, allowing the U.S. Fish and Wildlife Service to consider reintroducing the species in the wild. In 1987, four male-female pairs of red wolves were released in Alligator River National Wildlife Refuge (ARNWR) in northeastern North Carolina and designated as an experimental population. Since then, the experimental population has grown and the recovery area expanded to include four national wildlife refuges, a Department of Defense bombing range, state-owned lands, and private lands, encompassing about 1.7 million acres.

Adaptive Management

The recovery and restoration of red wolves requires the careful management of eastern coyotes (*C. latrans* var.) and occasionally wolf-coyote hybrids in the red wolf recovery area. The non-native coyotes spread across North Carolina to the red wolf recovery area in the early to mid-1990s. It soon was recognized that interbreeding between red wolves and eastern coyotes would produce hybrid offspring resulting in coyote gene introgression into the wild red wolf population, and that this introgression would threaten the restoration of red wolves. An adaptive management plan was developed to reduce interbreeding and introgression while simultaneously building the red wolf population. The adaptive management plan effectively uses techniques to capture and sterilize hormonally intact coyotes via vasectomy or tubal ligation, then releases the sterile canid at its place of capture to act as a territorial "placeholder" until the animal is replaced by wild red wolves. Sterile coyotes are not capable of breeding with other coyotes, effectively limiting the growth of the coyote population, nor are they capable of interbreeding with wild red wolves, limiting hybridization events. In addition, the sterile canid will exclude other coyotes from its territory. Ultimately, the placeholder canids are replaced by the larger red wolves either naturally by displacing the coyote or via management actions (e.g., removal of the coyote followed by insertion of wild or translocated wolves). Coyotes that are captured on private property are euthanized at the landowner's request.

Currently, adaptive management efforts are making progress in reducing the threat of coyotes to the red wolf population in northeastern North Carolina. Other threats, such as habitat fragmentation, disease, and anthropogenic mortality, also are of concern in the restoration of red wolves. Efforts to reduce these threats are presently being explored.

Program Objectives

The current recovery plan (U.S. Fish and Wildlife Service, 1990) specifies the following objectives:

1) Establish and maintain at least three red wolf populations via restoration projects within the historic range of the red wolf. Each population should be numerically large enough to have the potential for allowing natural evolutionary processes to work within the species. This must be paralleled by the cooperation and assistance of at least 30 captive-breeding facilities in the United States.
2) Preserve 80% to 90% of red wolf genetic diversity for 150 years.
3) Remove threats of extinction by achieving a wild population of approximately 220 wolves and a captive population of approximately 330 wolves.

4) Maintain the red wolf into perpetuity through embryo banking and cryogenic preservation of sperm.

Northeastern North Carolina Restored Population

We estimate between 90 and 110 red wolves in the Red Wolf Recovery Area, but for the purposes of this report all population figures are comprised only of known canids (i.e., those that are regularly monitored through either a functioning radio-collar or surgically implanted abdominal radio transmitter). Additional wolves are likely present, but have not been captured/radio-collared or their continued presence otherwise confirmed.

Beginning with the first quarter of the fiscal year 2012 (FY12) we have changed the way we report population and pack numbers. This change more accurately represents the managed population of canids that are part of our efforts to restore red wolves. The managed population includes wolf packs (i.e., packs consisting entirely of wolves) and mixed packs (i.e., packs of a wolf and sterile coyote pair). A pack is defined as at least two known canids cooperatively inhabiting an established territory.

Population and Territory Status

A total of 69 known red wolves occupied the Red Wolf Recovery Area (i.e., 1.7 million acres in five counties in northeastern North Carolina) at the end of the third quarter of our fiscal year 2013. The population includes 14 wolf packs (comprised of 45 wolves and 11 breeding pairs), and nine mixed packs (comprised of nine wolves and nine coyotes). An additional 15 wolves are not known to be associated with a pack.

The Red Wolf Recovery Program documented seven red wolf litters (comprised of 34 pups) born in the Red Wolf Recovery Area during the 2013 whelping season. Additional pups and/or litters could be present, but have not been confirmed. One additional pup born in captivity at Alligator River National Wildlife Refuge was fostered into a wild litter. Pups born during the 2013 whelping season are not included in the reported population numbers.

A total of 63 sterile coyotes were monitored in the Red Wolf Recovery Area at the end of this quarter.

Wolf Pairings

One breeding pair of red wolves was lost during the quarter when the resident breeding male was lost to contact.

One mixed (wolf-coyote) pair was lost during the quarter when the resident sterile female coyote was lost to contact.

Wolf Captures and Radio-Telemetry Marking

Three red wolves were captured during the quarter, none of which were first-time captures. One of these wolves was subsequently released after being vaccinated and fitted with a radio-collar, while the other two wolves are currently being held in captivity. Captured red wolves consisted of one adult male and two adult females.

Five coyotes were captured, sterilized, radio-collared, and released during the quarter. The captured coyotes consisted of one male and four females.

Dispersals

No known red wolves dispersed from their natal territories during the quarter.

No known red wolves or coyotes were displaced from their territories during the quarter.

Mortalities

No known red wolves from the Red Wolf Recovery Area are known to have died during the quarter.

Five sterile, radio-collared coyotes (1 male, 4 females) were known to have died during the quarter. Three of the deaths were the result of vehicle collision, one the result of gunshot, and one the cause of death could not be determined.

Disappearances

The Red Wolf Recovery Program lost radio contact with one adult male red wolf and thirteen coyotes (2 males, 11 females) during the quarter.

Pack Summaries

The Pack Summaries *section has been indefinitely discontinued due to recent events and current circumstances involving the apparent illegal take of red wolves within the Red Wolf Recovery Area.*

Species Survival Plan (SSP) Managed Population

Red Wolf Species Survival Plan (RWSSP) cooperating facilities are coordinated and managed by the SSP Coordinator and based at Point Defiance Zoo & Aquarium (PDZA) in Tacoma, Washington. The following information is based on activities completed or conducted by the SSP Coordinator during the quarter reported.

SSP Population Status

The SSP coordinates 43 captive facilities (e.g., approved zoos and nature centers) throughout the United States, housing 198 wolves, ranging from pups to geriatrics, at the end of the third quarter.

Four litters resulting in 23 pups were born at three SSP facilities this season (one litter at Sandy Ridge at ARNWR; one litter at Jackson Zoo, and two litters at PDZA's off-site facility). A single female pup from the Sandy Ridge litter was fostered to a wild-born litter.

Breeding / Transfer Recommendations

The SSP Coordinator reported that a total of nine wolves were transferred to four different SSP facilities during the third quarter.

Mortalities

Twelve wolf mortalities (3 adults, 9 pups) were reported at SSP sites. Neonate mortalities were associated with viral and bacterial infections. One adult male wolf housed at the Wildlife Science Center (WSC; Forest Lake, MN) and two adult female wolves at PDZA's off-site facility were reported to have died during the third quarter.

SSP Facilities Updates

The 2012 International Red Wolf Studbook was completed and distributed to designated individuals and organizations as required by WAZA International Studbook distribution list and posted on the AZA Website.

The Red Wolf Recovery Program received nearly $2300 from the Trevor Zoo (Millbrook, NY) through Trevor Zoo's involvement with the Keep Safe Project fundraising event. Information about the Keep Safe

Project and the fundraising event can be found at: www.keepsafeproject.com. The funds will be used to purchase new field equipment to support management efforts of the NENC wild red wolf population. We sincerely thank Trevor Zoo for including the Red Wolf Recovery Program in their Keep Safe Project fundraising event.

The Red Wolf Recovery Program was one of six organizations that benefitted from fundraising efforts through the Quarters for Conservation Program at Knoxville Zoo (Knoxville, TN) in June. For more information on the Knoxville Zoo and their Quarters for Conservation Program, please visit www.knoxville-zoo.org. Total proceeds from the Quarters for Conservation Program will be reported next quarter.

Other Activities

We would like to extend our gratitude to Mark MacAllister and Craig Standridge for their efforts in improving the RWSSP website. Check out the new website at: http://redwolfssp.org.

Three red wolf proposals were submitted to PDZA's Conservation Committee (ConCom) and were awarded funding. Many thanks to ConCom for supporting these projects:

1. Inflammatory bowel disease in the red wolf (*Canis rufus*): prevalence, clinicopathological and demographic characteristics. Award amount = $8125. Project Investigators: K. Wolf, K. Anderson, M. Garner, W. Waddell

2. Initial development of a canid disease monitoring and prevention program for the conservation of endangered red wolves (*Canis rufus*). Award amount = $2500. Project Investigators: B. Bartel, K. Wolf, D. Rabon, W. Waddell

3. Population viability analysis and preliminary demographic models of endangered red wolves (*Canis rufus*). Award Amount = $6200. Project Investigators: B. Bartel, D. Rabon, L. Faust, S. Long, W. Waddell

Island Propagation Sites

The U.S. Fish and Wildlife Service utilizes island sites to propagate red wolves and contribute to the restoration of a wild red wolf population, primarily by inserting island-born wolves into the wild population as a means to augment the wild red wolf gene pool with "under-represented" genes from the captive population. Currently, the Red Wolf Recovery Program cooperates with St. Vincent National Wildlife Refuge in maintaining a breeding pair of red wolves on an island site.

Collaborations

Research

The Red Wolf Recovery Program provided financial and in-kind support for collaborative research with scientists at other institutions, including universities, interagency divisions, and non-government research organizations. These investigations required project staff to assist outside researchers and graduate students in their efforts to better understand red wolf ecology, ecosystem function, and conservation efforts.

Project Title: Prevalence of cystic endometrial hyperplasia and its effect on reproduction in the red wolf (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigator: Kadie Anderson, DVM, and Karen Wolf, DVM, Dipl. ACZM, Point Defiance Zoo & Aquarium (PDZA)

Project Title: Inbreeding avoidance in red wolves.
Graduate Student: Kristin Brzeski (PhD student)
Committee Chair/Principal Investigator: Sabrina Taylor, PhD, Louisiana State University

Project Title: Identifying management procedures to reduce red wolf-coyote interactions in eastern North Carolina.
Graduate Student: Joseph Hinton (PhD student)
Committee Chair/Principal Investigator: Michael Chamberlain, PhD, University of Georgia

Project Title: Use of stable isotope analysis to elucidate predation patterns of sympatric canids.
Graduate Student: Anne-Marie Hodge (MS student)
Committee Chair/Principal Investigator: Brian Arbogast, PhD, University of North Carolina at Wilmington

Project Title: Evaluating potential effects of widening US Highway 64 on red wolves, Washington, Tyrrell, and Dare Counties, North Carolina.
Graduate Student: Christine Proctor (PhD student)
Committee Chair/Principal Investigator: Michael R. Vaughan, PhD, Virginia Polytechnic Institute and State University (Virginia Tech)

Project Title: Sperm morphology and motility of the red wolf (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigators: Albrecht Schulte-Hostedde, PhD, Laurentian University, and Gabriela Mastromonaco, PhD, Toronto Zoo

Publications

The following publications have gone to print in this quarter. A complete list of publications related to red wolves can be found at http://www.fws.gov/redwolf/images/RWBibliography.pdf.

Beeland, T.D. 2013. The Secret World of Red Wolves: The fight to save North America's other wolf. University of North Carolina Press.

Desmul, L. 2013. Habitat connectivity and suitability for *Canis rufus* recovery. Master's Thesis. Duke University.

Hutt, N. 2013. A Closer Look at Red Wolf Recovery: A conversation with Dr. David R. Rabon. International Wolf Magazine, a publication of The International Wolf Center - Summer 2013.

Standridge, C., and B. Graham. 2013. Return of the Red Wolf, printed by the Point Defiance Zoological Society.

Presentations

No presentations by collaborators were reported during this quarter.

Staff and Volunteers

The Red Wolf Recovery Program employs eight full-time staff, including the program coordinator, assistant coordinator, field coordinator, three wildlife biologists, a biological technician, and an administrative assistant. The Red Wolf Recovery Program also benefits from unpaid interns (Caretakers).

Outreach

Staff from the Red Wolf Recovery Program conduct presentations and attend events to inform and educate the public on the conservation needs of the red wolf and the restoration efforts of the Red Wolf Recovery Program. As part of our effort to assist educators, red wolf "discovery boxes" that include materials about the red wolf are distributed to educational facilities. The distribution of discovery boxes is managed by the Red Wolf Coalition. Requests for discovery boxes should be made to kwheeler@redwolves.com.

The Red Wolf Recovery Program also seeks to achieve a quality visitor and participant experience in the U.S. Fish and Wildlife Service's priority recreational uses on National Wildlife Refuges. Our outreach efforts focus on four of the six program elements, including wildlife observation, wildlife photography, environmental education, and interpretation, and are conducted frequently in partnership with ARNWR and Pocosin Lakes National Wildlife Refuge (PLNWR) educators and volunteers.

Presentations

Date	Location	Audience	Length	Attendance	Presenter
April 11	Newport News, VA	Christopher Newport University	1 hr	~40	B. Bartel
April 27	ARNWR	Howling Safari	2 hrs	35	L. Baxter
May 25	ARNWR	Howling Safari	2 hrs	45	L. Baxter
May 29	Davidson, NC	Sustainability Scholars, Davidson College	1 hr	14	D. Rabon
June 5	ARNWR	Howling Safari	2 hrs	22	L. Baxter
June 12	ARNWR	Howling Safari	2 hrs	28	L. Baxter
June 17	Manteo, NC	Cub Scouts Day Camp	1 hr	40	L. Baxter
June 19	ARNWR	Howling Safari	2 hrs	37	L. Baxter
June 26	ARNWR	Howling Safari	2 hrs	32	L. Baxter

Website / Social Media

The Red Wolf Recovery Program recently launched Facebook and Flickr internet pages. Our Facebook page connects our program with "friends" from around the world and informs them of the conservation efforts of the Red Wolf Recovery Program. The Facebook page can be found at www.facebook.com/redwolfrecoveryprogram. Our Flickr page provides a site for users to view and download high resolution pictures related to red wolves and the Red Wolf Recovery Program. Our Flickr page can be found at www.flickr.com/photos/trackthepack.

The Red Wolf Recovery Program also has a weblog that highlights the efforts of the Red Wolf Recovery Program staff in the conservation of the red wolf. The weblog combines text, images, videos, and links to other media related to its topic. The content includes educational, informational, and general journal entries written by program staff, and allows readers to leave comments in an interactive format. The weblog can be found at trackthepack.blogspot.com.

Media Inquires

The Red Wolf Recovery Program responded to numerous media inquiries during this quarter, including the Downeast Journal of Public Radio East.

Partnerships

Red Wolf Coalition

The Red Wolf Coalition (RWC), a not-for-profit education organization based in Columbia, NC, advocates for the long term survival of wild red wolf populations by teaching about red wolves and by engaging the public in red wolf conservation. The RWC's web site (www.redwolves.com) provides information about the history, biology, and ecology of red wolves, as well as news about red wolf restoration. The RWC gives red wolf programs to school groups, professional organizations, university students, and other groups. The RWC also conducts workshops for teachers and non-formal educators, including people seeking certification in environmental education.

The RWC held an open house at the Red Wolf Education Center (Columbia, NC) in conjunction with PLNWR on April 13. Attendees were able to see the ambassador red wolves that live on site, learn about red wolf conservation and the importance of refuge properties, make their own red wolf bracelet or necklace, and try their hand at archery. The RWC Executive Director reported about 100 people in attendance at this event.

The RWC Executive Director reported conducting several education programs during the quarter, including presentations to students and faculty from East Carolina University (Greenville, NC), to visitors from Davidson College (Davidson, NC), to a visiting birding group from Raleigh (Raleigh, NC), and to a local daycare facility (Columbia, NC). The RWC also participated in a science camp at with PLNWR on June 18.

The RWC is offering multiple summer educational programs and activities at the Red Wolf Education and Healthcare Facility (Columbia, NC), including Talk Like a Red Wolf, Red Wolf 101, and Red Wolf. These programs provide families and small groups an introduction to red wolves, their lives and their conservation. Reservations are required for those wishing to attend an event and can be scheduled online (http://redwolves.com/program/) or by phone (252-796-5600).

The RWC also has three Red Wolf Discovery Boxes for all grade levels available for educational use. These boxes are filled with a variety of hands-on items, activities and artifacts that help students explore the world of red wolves. The red wolf curriculum *Far Traveler* and a variety of books and other resources also are included. Contact Kim Wheeler at 252-796-5600 or kwheeler@redwolves.com for more information or to reserve your Red Wolf Discovery Box. Red Wolf Discovery Boxes were sent to 3 different groups this quarter.

Friends of the Red Wolf

The Friends of the Red Wolf is a non-profit organization established to support the conservation and recovery of wild red wolves. They are a program of The WILD Foundation (www.wild.org) which shares its 501(c)3 non-profit status, and enables all donations to be tax-deductible as charitable contributions. The Friends of the Red Wolf is informed by sound scientific research and adaptive management practices, and directly collaborates with Wolf Recovery Program in helping achieve recovery goals for the red wolf. Their website (friendsofredwolves.org) provides information about the ecology of red wolves, as well as news and updates about red wolf restoration.

DeLene Beeland, founder of the Friends of the Red Wolf recently published a new book, The Secret World of Red Wolves: The Fight to Save North America's Other Wolf, in which she shadowed the Red Wolf Recovery Program over the course of a year and crafted an intimate portrait of the red wolf, its natural history, and its restoration. She participated in multiple media events to promote the book's release, including interviews with Catfish Radio (www.ketr.org - Outdoors with Luke Clayton program), NC Sea Grant Coastwatch magazine, and WUNC Public Radio's The State of Things (http://wunc.org/post/red-wolves-return-wild). She also reports one fundraising event through Friends of the Red Wolf Facebook page that resulted in about $500 of donations, which will be used to purchase new field equipment to support management efforts of the NENC wild red wolf population. Thank you DeLene and the Friends of the Red Wolf for your support!

Announcements

Kristin Brzeski (PhD student at Louisiana State University) recently received a Doctoral Dissertation Improvement Grant from the National Science Foundation to examine immunocompetence and disease resistance in the wild red wolf population. Congratulations Kristin!

From the Field: Implementing recovery of the red wolf—integrating research scientists and managers

Michael K. Stoskopf, Karen Beck, Bud B. Fazio, Todd K. Fuller, Eric M. Gese, Brian T. Kelly, Frederick F. Knowlton, Dennis L. Murray, William Waddell, and Lisette Waits

Abstract The United States Fish and Wildlife Service (USFWS) developed guidelines for the composition and role of endangered species recovery implementation teams, but few teams have been established and their success has not been evaluated. Using the recovery program of the red wolf (*Canis rufus*) as a model, we describe the genesis, function, and success of the Red Wolf Recovery Implementation Team (RWRIT) in helping guide the establishment of a viable red wolf population in eastern North Carolina. In operation since 1999, the RWRIT meets bi-annually to review USFWS progress and provide recommendations aimed at maximizing success of species recovery. The team is comprised of 8 research scientists from disciplines including population genetics, canid ecology, population ecology, veterinary medicine, and captive management. Representation from each of these disciplines is deemed necessary for proper evaluation of recovery progress and assessment of future needs. Meeting attendance by the USFWS field management team ensures both proper reporting of past progress and future implementation of management recommendations. Over time, RWRIT members have assumed specific assignments for data analyses, further contributing to the recovery effort. Through the combined efforts of the USFWS field team and the RWRIT, the threat of introgression of coyote (*Canis latrans*) genes into the red wolf population has been substantially curtailed within the recovery area, and red wolf numbers and range have increased. The RWRIT serves as an example of a recovery implementation team that is successfully incorporating the principles of adaptive management and whose template could be adapted to other endangered species.

Key words adaptive management, *Canis rufus*, endangered species, implementation, recovery, red wolf

Recovery of any endangered species is influenced by a range of political, economic, social, as well as biological issues (Tear et al. 1993, Scott et al. 1995, Lundquist et al. 2002). Reconciling disparate concerns and perspectives into a cohesive program requires planning and decision-making processes that consider conflicting interests of various stakeholders. However, for a recovery program to succeed, it is equally critical that professionals tasked with the responsibility for managing endangered species be able to move forward with timely decisions based on practical management needs and scientific knowledge (Westrum 1994). The United States Fish and Wildlife Service (USFWS) red wolf (*Canis rufus*) recovery program is an example of a program faced with complex issues, where man-

agement successes have been strengthened and accelerated by integrating active adaptive management with careful and timely scientific inquiry. This paper describes how this integration is being achieved via a designated "recovery implementation team."

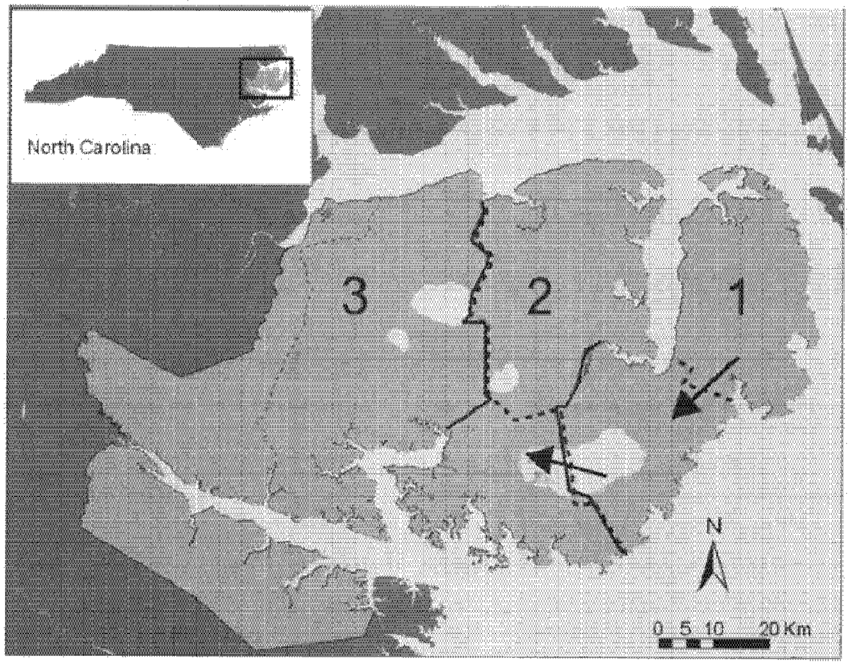

Figure 1. Changes in management zone boundaries within the Red Wolf Recovery Area of eastern North Carolina, as made in accordance with Red Wolf Adaptive Management Plans. The boundaries of the original management Zones 1, 2, and 3 (dashed lines) were first established in April 2000. In March 2002, as red wolf recovery proceeded, boundaries in the southern parts of the zones were moved west (solid lines); part of Zone 2 became Zone 1, while part of Zone 3 became Zone 2 (arrows). In August 2003 some management aspects of canids (i.e., sterilization vs. euthanasia) captured in the eastern half of Zone 3 (thin dotted line) began to follow guidelines applied to Zone 2.

The red wolf is an endangered species that once roamed an extensive range including the southeastern United States, and possibly the entire woodlands of eastern North America (Wilson et al. 2000, Nowak 2002, Grewal et al. 2004). Although listed as endangered in 1967 (USFWS, 1967), population decline and apparent hybridization with coyotes (*Canis latrans*) were recognized in the early 1960s (McCarley 1962, McCarley and Carley 1979). The remaining red wolves were removed from the wild in the mid- to late 1970s with the goals of establishing a captive breeding program and eventually restoring captive-bred animals to portions of their historical range (U.S. Fish and Wildlife Service [USFWS] 1989). In 1987 the first red wolves were released in easternmost North Carolina (Figure 1) with the plan to establish a viable population (Parker 1987). The reintroduction efforts faced a myriad of social, political, and biological issues as the Red Wolf Recovery Plan (USFWS 1989) was implemented (Henry and Lucash 2000, Phillips et al. 2003).

Although the reintroduction area was initially considered uninhabited by coyotes, by the mid-1990s it was apparent coyotes had infiltrated the area and hybridization with red wolves was recurring (Phillips et al. 2003). Due primarily to the renewed hybrid threat and termination of the reintroduction of red wolves into Great Smoky Mountains National Park (Henry 1998), the USFWS decided it needed to re-evaluate its red wolf recovery effort in light of what had been learned over the previous decade. A key step in this review process involved a Population and Habitat Viability Assessment (PHVA) organized by the USFWS in 1999 and facilitated by the Conservation Breeding Specialists Group of the World Conservation Union, Species Survival Commission (IUCN SSC) (Kelly et al. 1999). The diverse assemblage of attendees, representing a variety of expertise and interests, agreed that introgression of coyote genes into the red wolf population was the principal threat to recovery success (Kelly et al. 1999). The group also recognized this issue required urgent attention before hybridization became so pervasive as to virtually ensure the genetic swamping of the only extant free-ranging population of red wolves. However, 2 views of how to address the hybrid threat emerged from the PHVA; one believed research was integral to addressing the problem, and the other expressed concern that research efforts would distract from the primary goal of maintaining the only free-ranging population of red wolves in the world. A consensus agreement was reached on this debate and resulted in an overarch-

ing workshop statement, including:

> "...our primary recovery focus must be protecting and promoting the growth of a self-sustaining, non-hybridizing population of red wolves in the wild and sustaining an active captive component. Actions to be taken will use an adaptive management approach that will not compromise the ability to achieve this goal." (USFWS 1999:52)

This level of agreement among the diverse participants of the PHVA set the stage for designing an adaptive management plan (*cf.* Lancia et al. 1996) that would reduce the threat of wolf-coyote hybridization. This plan (Kelly 2000) diverged from conventional endangered species management because it involved an incremental process tailored to modify field protocols according to past success in eliminating the threat of hybridization. Specifically, it required the release area to be segregated into several defined management zones, each managed to provide an integrated optimization of risk reduction within the resource limitations available to the project (Figure 1). As nonwolf canids were removed from given zones and replaced with red wolves, management options could be adapted by modifying zone boundaries or adjusting specific management protocols.

Adoption of this plan, requiring frequent re-evaluation of data and attendant management adjustments, spawned close interactions between USFWS field biologists and scientists with backgrounds relevant to the work being undertaken. A Red Wolf Recovery Implementation Team (RWRIT) was formed to advise USFWS as they implemented the adaptive management plan; this team was created pursuant to Section 4(f)(2) of the amended Endangered Species Act (ESA), which authorizes the Secretary of the Interior to procure the services of appropriate public and private agencies, institutions, and other qualified persons to help implement endangered species recovery plans. Other USFWS-designated species-specific implementation teams, as opposed to planning teams, have been formed (e.g., black-footed ferret [*Mustela nigripes*], northern right whale [*Eubalaena glacialis*], Okaloosa darter [*Etheostoma okaloosae*], and southern sea otter [*Enhydra lutris*]; USFWS files), but they are rare and no formal description of one's workings or success has yet been documented.

Recovery implementation team composition

Selection of the RWRIT scientists and their leadership was important to the success of implementing and evaluating the adaptive management plan. The PHVA helped the USFWS identify individuals with the combined expertise and personality considered important in a functional RWRIT. The PHVA also provided insight to the breadth of expertise needed over the long term. This expertise included such diverse fields as systematics, genetics, population modeling, health management, and canid biology, behavior, ecology, and management. Social scientists were not required in this case because those issues were, and continue to be, successfully dealt with by the USFWS field management team in conjunction with non-governmental organizations (Henry and Lucash 2000). Direct experience with the red wolf was not a requisite criterion for RWRIT membership. In fact, due to the long and controversial scientific history of the red wolf, some team members were sought for their naiveté of red wolves to minimize preconceived notions regarding the problems the adaptive management plan addressed. Thus, a mixture of experienced and young research scientists with strong records of scientific productivity and interpersonal skills was selected. Each member of the RWRIT had to be willing to use a data-driven approach to decision-making while remaining open to challenges of interpretation. Each member also had to be willing to accept group decisions as well as devote considerable personal time toward solving issues associated with the red wolf program.

The RWRIT needed to be large enough to provide the scientific diversity needed to assess the broad range of critical issues, but small enough to support close working relationships among members and result in productive meetings (Clark and Westrum 1989). A basic philosophy was that if the RWRIT needed expertise from individuals or disciplines outside the RWRIT to address specific issues, guest scientists would be invited to participate in the appropriate meetings. Initially, a goal of 8 members and 4 alternates was considered. Interactions of the group and reliability of participation in early meetings were used to identify the core members of the RWRIT. Since then, the size and composition of the RWRIT (8 members, no alternates) has worked well, sustaining effective decision-making with absences at meetings being rare. The leader of

the RWRIT needed to moderate meetings efficiently while allowing for creative interactions among RWRIT members. To ensure this, a senior scientist at a local university was selected due to his demonstrated scientific and leadership skills.

Experienced and stable field team

The USFWS field team involved in the day-to-day operation and management of the red wolf recovery program was key to the success of the RWRIT. The field team attended all RWRIT meetings as nonvoting members and provided the necessary data and expertise for the meetings to progress effectively. This distinction between the teams initially caused some anxiety, but this subsided once roles had been fully elucidated. The field team is remarkably stable and has worked cohesively on the red wolf project for many years (Phillips et al. 2003). Scientists of the RWRIT recognize the field team as the most experienced red wolf biologists and essential for successful functioning of the RWRIT itself. In turn, the field team's willingness to listen to and implement recommendations made by the RWRIT has been a critical factor in the success of the program. Open communications between the 2 teams keeps RWRIT scientists aware of the implementation of recommendations and fosters respect for the dedication of the field team.

Getting started

The first meeting of the RWRIT was important in establishing the tenor of group interactions and future functioning. Subsequent meetings would focus on examining data related to specific questions within an established agenda, but the first meeting focused on developing operating procedures for decisions as well as the types of data and data formats the team preferred for review and evaluation. This was a step that helped acquaint members of the team and recognize proper working protocols. It also ensured that all members of the team had a common understanding of the Red Wolf Adaptive Management Plan (RWAMP).

The charge of the RWRIT was established a priori by the Team Leader of the Red Wolf Recovery Program (i.e.,"Red Wolf Program Leader"). This task was defined specifically as reviewing progress on the RWAMP and recommending changes to the plan based on data provided by the USFWS. As the team gained experience, this charge evolved to include recommendations for data relevant to answering specific questions important to the field team in the day-to-day management of the wild red wolf population. The 2 charges were closely related, frequently blended, seldom distinct, fundamental to the Adaptive Management Paradigm (Walters 1986), and are the responsibilities that drive efforts of RWRIT members. From the beginning, per the ESA, RWRIT recommendations were strictly advisory, with decisions for implementation being at the discretion of the USFWS.

Ground rules established in the first meeting have rarely been adjusted. Some established the mechanics of operations. For example, it was decided a minimum of 6 RWRIT members would be required as a quorum for a functional meeting. Failure to achieve quorum would trigger an evaluation by the RWRIT Leader and the Red Wolf Program Leader to assess whether the RWRIT remained an appropriate mechanism. To date this has not been necessary due to continued strong and enthusiastic attendance.

Other rules provided guidance for RWRIT interactions. To reduce stifling potentially meritorious but perhaps unconventional ideas, the team adopted a basic rule indicating that speakers must present alternative solutions when challenging or negating a proposed idea or approach. Ideas would be withdrawn from consideration only after careful efforts to refine them failed to produce workable solutions. To the fullest extent possible, data would be used to support all positions.

Other procedural mechanisms established in the first meeting have had a beneficial effect on RWRIT operations. For example, tentative dates, times, and location of future meetings are established jointly early in the agenda of each meeting. In addition, the agenda of the next meeting is established near the completion of the current session, which probably produces a more dynamic agenda than a call just before the meeting. Opportunities to add agenda items at any time remain, but the draft of the agenda appears in the final minutes; serving as a reminder for participants as they prepare for the coming meeting.

An important activity reserved for the end of each meeting is an exercise in prioritizing "action items", which are further classified as either "tasks" (expected to be accomplished within the time frame of the meeting or between meetings); "projects" (longer duration activities); or "manuscripts" (the drafting of information for publication).

Individual RWRIT members are recognized as responsible for addressing each item. With many issues to consider and an active agenda, many more action items are identified than can typically be accomplished with the resources available. The action items established throughout the meeting and recognized as "projects" are assembled in a descriptive list and as a final exercise, each member of the RWRIT assigns a priority level to each item and the mean rating is computed. This rating is offered to the Red Wolf Program Leader as a recommendation for activities to pursue or fund. At the first meeting, a pattern was established where RWRIT members worked to identify key management questions and to focus scientific inquiry in areas of need with constant reference to the adaptive management plan. Assets are identified and resource limitations discussed so recommendations have a reasonable likelihood of implementation. Short proposals outlining the objective of projects and the team member(s) involved in the work are distributed to the RWRIT via the team's webpage. The webpage also includes team member contact information, minutes of meetings (see below), data sets, reports, press releases, publications, project descriptions, manuscripts in progress, and upcoming meeting agendas and related materials such as reports and summaries.

Since 2000 the RWRIT has met bi-annually, which is sufficient to respond in a timely manner to questions from the field and to strengthen collegial bonds among members. This schedule also allows sufficient time for the field team to implement recommendations and to document their progress and for RWRIT members to work independently on action items. Other factors affecting meeting schedules include a need to make recommendations ahead of budget deadlines and to accommodate schedules of the individual RWRIT members and the field team. The current pattern of meetings includes 1 meeting in March prior to the denning season and a second in October prior to intensive trapping efforts.

Staying flexible

Any group with dynamic tasks needs a mechanism for adjusting the nature of the group as it matures and as tasks change (Clark and Reading 1994). The concept of alternate members soon was abandoned because of the strong attendance by RWRIT members and because it reduced inefficiencies associated with updating new attendees. The ability to invite experts in areas not represented on the RWRIT provides a mechanism to maintain flexibility and adaptability. Periodic review of expertise needed for specific tasks and projects of the RWRIT keeps the issue of change before the team. In addition, there exists ample opportunity to discuss candidly both the pros and cons of the teams' efforts, either formally at the end of each meeting or informally during meals or after hours. The RWRIT Leader needs to recognize dissenting views and address contentious issues promptly and effectively. The fact that for most meetings the entire RWRIT was communally housed in rented accommodations further ensured the establishment of favorable personal relationships benefiting RWRIT interactions and discussion.

Complete minutes of RWRIT deliberations provide documentation of the team's discussions and recommendations. An iterative process of editing minutes is used by the RWRIT, ensuring important information developed at each meeting is recorded accurately and in language deemed appropriate by the participants. Notes are converted into a draft each evening and individualized, and printed copies are distributed to attendees the following morning for editing. All drafts are synthesized into the penultimate draft for further comment, which is followed by a final draft distributed electronically shortly after completion of the meeting. The RWRIT members have a week to return any corrections, after which the final minutes are completed and distributed electronically. The deliberations of the RWRIT are considered privileged communication, and all meeting participants are asked to limit discussions of information received at the meetings to individuals within their respective research groups. This policy allows RWRIT members access to sensitive and preliminary data and provides more freedom of discussion without concerns about inappropriate disclosure. Distribution of the minutes beyond the RWRIT is at the discretion of the Red Wolf Program Leader.

How well does it work?

The test of any system is how well it functions to meet the goals and objectives of the program it serves. In the 4 years since the first formal meeting of the RWRIT, key challenges to implementing the plan developed at the PHVA have been identified and strategies have been devised to provide practi-

cal solutions and evaluate success of recovery efforts. Perhaps more importantly, all RWRIT members and the entire red wolf field team have become close colleagues who look forward to each meeting. We enjoy the frank and open exchange of ideas, the ability to quickly address both practical and theoretical problems and make changes in management practices, and the successes in the field that result from the collaboration. The details of these changes and successes are the basis of several scientific papers, some already published or in press and others currently in preparation, but a brief summary is warranted.

Prior to 1998 all canids captured in the red wolf recovery area were assumed to be wolves unless they were so small as to be considered coyotes, if they were black, or if they looked part dog. If there was some indication that a single female wolf was consorting with a coyote or dog, pups she produced were removed (A. Beyer, USFWS, personal communication). Thus, the basic challenge of rapidly and confidently identifying animals as red wolves versus hybrids or coyotes, especially young animals, was identified early as a key concern of the PHVA and the field team. The RWRIT served as catalyst for developing an enhanced and improved genomic testing protocol by expanding the ability to assess alleles at 19 loci (Miller et al. 2003). A priority placed on obtaining genomic assessments of the entire group of founders in the captive breeding program, as well for coyotes in the vicinity of the wolf release zones, greatly improved the confidence in the genomic data now available. Genetic analyses were integrated with pedigree and morphometric data to develop decision trees for all captured animals (Table 1). Extension of the DNA analysis capabilities to fecal samples increased the potential for assessing presence of red wolves, as well as undesired non-red wolves, in the field samples without the need of capturing and handling animals (Adams et al. 2003). Additional research efforts were directed at using this technology for assessing red wolf population size (J. R. Adams and L. P. Waits, University of Idaho, unpublished data).

To evaluate progress of the adaptive management plan, RWRIT scientists wanted detailed and current descriptions of animal locations, their genotypes, and canid inventory efforts in relation to geographic areas. A coordinated Geographic Information System (GIS) database system is now used at all RWRIT meetings to examine recovery progress. This is steadily approaching the goal of a real-time data view as data entry and validation challenges are addressed and data summaries are refined. These tools help identify areas where data are insufficient to define the status of canids and help develop strategies to eliminate so-called "areas of ignorance" by concentrating efforts in areas needing more attention. In addition, they have lead to improved ground telemetry efforts and more efficient use of resources and personnel.

Modeling effects of coyote genomic intrusion, using more refined data sets and newer models than available at the PHVA, provided RWRIT scien-

Table 1. Decision path for genetic results of red wolves (RW) captured in the experimental population area in northeastern North Carolina, applied in fall of 2003 (explanation of genetic result classifications given in Miller et al. 2003). Decision parameters listed in the following priority: Genetic testing; Pedigree; Morphology; Mate.

	Capture location[a]	
Decision parameter	Zone 1	Zone 2
1. Genetic test: 100% RW (pedigree 100% RW)	Release	Release
1. Genetic test: 100% RW but cannot exclude 75% RW hypothesis	Consider pedigree (go to 2)	
2. Pedigree is 100% to 87.5% RW	Release	Release
2. Pedigree is 87% to 75% RW or unknown	Consider morphology (go to 3)	
3. Morphologically "hybrid-like"	Euthanize	Sterilize
3. Morphologically "RW-like"	Consider mate (go to 4)	
4. Mate is ≥75% RW	Release	Release
4. Mate is <75% RW or uncertain	Euthanize	Sterilize 1 mate
1. Genetic Test: 75% RW or 75% RW but cannot exclude 50% RW hypothesis	Consider pedigree (go to 5)	
5. Pedigree is <75% RW	Euthanize	Sterilize
5. Pedigree is ≥75% RW or unknown	Consider morphology (go to 3)	

[a] See Figure 1.

tists new insights into impacts of genomic intrusion (e.g., Miller et al. 2003). This allowed for key insights to establishing acceptable risks defined in the decision trees. This also assisted in the making of informed recommendations for modifying approaches to the various management zones for red wolf recovery. Recently, the RWRIT initiated an effort to conduct detailed analyses of home range, spatial interactions, habitat use, and demographic attributes of all radiomonitored red wolves since 1986, with the objective of developing a population viability model to help guide future management and recovery actions. Den management techniques via implementation of early genomic sampling and use of cross-fostering of wild-caught and captive bred pups into wild litters have been developed (cf. Kitchen and Knowlton, *in press*). Methodology also has been enhanced to conduct surgical procedures to support the use of hormonally intact but sterile hybrids and coyotes to serve as sterile buffers (i.e., temporary territory placeholders that discourage establishment of new, intact nonwolves) in peripheral management zones (Figure 1).

The net result of such activities has led to an increase in the area occupied by red wolves, total number of red wolves, and number of red wolf social units, as well as a major decrease in the total area where the status of canids, in general, is unknown (B. B. Fazio, USFWS, unpublished data). Such changes in these metrics were identified in the RWAMP as key indicators of the successful management of wolf-coyote hybridization. Importantly, coyotes or hybrids have essentially been eliminated from fully half of the red wolf recovery area. To date, genetic intrusion into the red wolf population has been largely controlled, albeit through aggressive intervention.

The effective functioning of the RWRIT has ensured that issues identified at the PHVA as described in the RWAMP have been, or are being, successfully addressed by USFWS. And as should be expected, the original red wolf adaptive management plan is now revised to include 5 years of evolving adaptive management (Fazio et al. 2004). The approach taken by the RWRIT represents a good example of successful application of the Adaptive Resource Management paradigm and is likewise consistent with, and respectful of, concerns raised by the participants at the PHVA that the primary goal of conserving the only free-ranging population of red wolves not be overshadowed by the desire to conduct research. Indeed, the USFWS recently highlighted the efforts of the Red Wolf Recovery Program in a videotape on how the use of sound science is key to meeting its mission.

We believe the recent tangible success in red wolf recovery is a direct result of conducting the PHVA, crafting a RWAMP, establishing the RWRIT, and the cooperation and close interaction between the RWRIT and the USFWS field team directly tasked with red wolf recovery. Endangered species recovery should involve a strong linkage between scientific investigation under the rubric of adaptive management and the appropriate blend of social, political, and economic issues (Clark et al. 1994). In light of the mixed past success in recovering endangered species in the United States (Crouse et al. 2002, Gerber and Hatch 2002), we believe, based on the success of the RWRIT, that recovery implementation teams can serve as an effective vehicle for helping guide recovery programs and actions.

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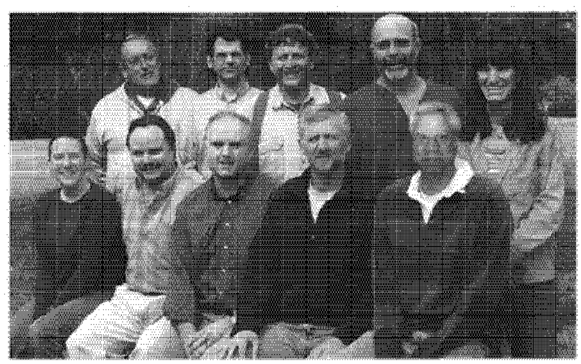

The collaborators on this paper have a variety of academic degrees, work experiences, and publications in a wide selection of fields and disciplines and have studied species from A to Z. They include (seated, from left to right) ***Karen Beck*** (ecological epidemiologist), ***Buddy Fazio*** (fiscal conservationist), ***Todd Fuller*** (quasi-experimental theoriologist), ***Eric Gese*** (investigative carnivologist), and ***Brian Kelly*** (politico-ecologist), and (standing, left to right) ***Fred Knowlton*** (historical canidilist), ***Dennis Murray*** (taxon-free numero-ecologist), ***Michael Stoskopf*** (conservation metabonomist), ***Will Waddell*** (ex-situ zoologist), and ***Lisette Waits*** (pan-molecular faecologist).

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Managing hybridization of a recovering endangered species: The red wolf *Canis rufus* as a case study

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Abstract Hybridization presents a unique challenge for conservation biologists and managers. While hybridization is an important evolutionary process, hybridization is also a threat formany native species. The endangered species recovery effort for the red wolf *Canis rufus* is a classic system for understanding and addressing the challenges of hybridization. From 1987–1993, 63 red wolves were released from captivity in eastern North Carolina, USA, to establish a free-ranging, non-essential experimental population. By 1999, managers recognized hybridization with invasive coyotes *Canis latrans* was the single greatest threat to successful recovery, and an adaptive management plan was adopted with innovative approaches for managing the threat of hybridization. Here we review the application and results of the adaptive management efforts from 1993 to 2013 by comparing: (1) the numbers of wolves, coyotes, and hybrids captured, (2) the numbers of territorial social groups with presumed breeding capabilities, (3) the number of red wolf and hybrid litters documented each year and (4) the degree of coyote introgression into the wild red wolf gene pool. We documented substantial increases in the number of known red wolves and red wolf social groups from 1987–2004 followed by a plateau and slight decline by 2013.The number of red wolf litters exceeded hybrid litters each year and the proportion of hybrid litters per year averaged 21%. The genetic composition of the wild red wolf population is estimated to include < 4% coyote ancestry from recent introgression since reintroduction. We conclude that the adaptive management plan was effective at reducing the introgression of coyote genes into the red wolf population, but population recovery of red wolves will require continuation of the current management plan, or alternative approaches, for the foreseeable future. More broadly, we discuss the lessons learned from red wolf adaptive management that could assist other endangered species recovery efforts facing the challenge of minimizing hybridization [*Current Zoology* 61 (1): 191–205, 2015].

Keywords Canid, Conservation, Genetics, Hybrid, Management

Hybridization, the interbreeding among distinct taxa, presents a unique challenge for conservation biologists and managers. While hybridization is an important evolutionary process for speciation (Arnold, 1992; Allendorf et al., 2001), hybridization also poses a threat to the conservation of native species, particularly when it is facilitated by anthropogenic alteration of habitats, translocation of species, and excessive exploitation (Wayne et al., 2004). Such human activities have caused a global escalation in hybridization, resulting in multiple extinctions of plant and animal populations and species (Rhymer and Simberoff, 1996; Wolf et al., 2001). The need to develop strategies to minimize anthropogenic-driven hybridization is a key conservation challenge (Allendorf et al., 2001).

Hybridization followed by introgression is the most difficult type of hybridization to control and manage (Allendorf et al., 2001). Over time, breeding among hybrids and backcrossing of hybrids and parentals can lead to the formation of a hybrid swarm and the loss of

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the gene pool of one or both parental species (Rhymer and Simberloff, 1996). This process, known as genomic extinction (Allendorf and Luikart, 2007), has been documented as a major threat for a diverse group of plant and animal taxa (McCarley, 1962; Rogers et al., 1982; Dowling and Childs, 1992; Abernethy, 1994; Rhymer et al., 1994), including several species of wild canids (Wayne et al., 2004).

One intensive effort to address the threat of hybridization and introgression has been implemented for the endangered red wolf (*Canis rufus*; USFWS, 1989). This species, first described by Bartram (1791), was listed as endangered in 1967, and starting in 1973 the last known wild individuals were captured and placed in a captive breeding program to avoid genomic extinction due to hybridization with coyotes *C. latrans*. The red wolf recovery effort has been clouded by debate over the taxonomic status and evolutionary history of this species. It has been classified as a distinct species (Nowak, 1979, 2002), a species of hybrid origin due to breeding between gray wolves *C. lupus* and coyotes (Wayne and Jenks, 1991; Roy et al., 1994, 1996), and as member of a third group of independently evolving North American canids called the eastern wolf *Canis lycaon* that includes the Algonquin wolf and wolf-like canids in the Great Lakes region (Wilson et al., 2000, 2003; Kyle et al., 2006, 2007). The grouping of red wolves and eastern wolves as a distinct species was challenged by results from a large-scale genomic survey of grey wolves, coyotes, red wolves and eastern wolves (VonHoldt et al., 2011). Using over 48,000 single nucleotide polymorphism (SNP) loci, VonHoldt et al. (2011) rejected the hypothesis that red wolves were part of a third species group of North American canids and concluded there were only two main groups of canids in North America (coyotes and gray wolves), and red wolves and eastern wolves have a hybrid origin. In response, Rutledge et al. (2012b) argued the VonHoldt et al. (2011) study included insufficient sampling of Algonquin wolves (n = 2) and flawed analyses. After reanalysis of the VonHoldt et al. (2011) data, they concluded that the three species hypothesis grouping Algonquin wolves and red wolves cannot be rejected.

The goal of this study was not to address the red wolf taxonomic debate but instead to evaluate the efforts of the U.S. Fish and Wildlife Service (USFWS) to prevent introgression of coyote genes into the reintroduced wild population. Between 1987 and 1993, the USFWS reintroduced red wolves to the Alligator River National Wildlife Refuge (ARNWR) in northeastern North Carolina to re-establish a free-ranging experimental population (Phillips et al., 2003). The experimental population area (Fig. 1) primarily encompassed the Albemarle Peninsula, which was characterized by a diversity of habi-

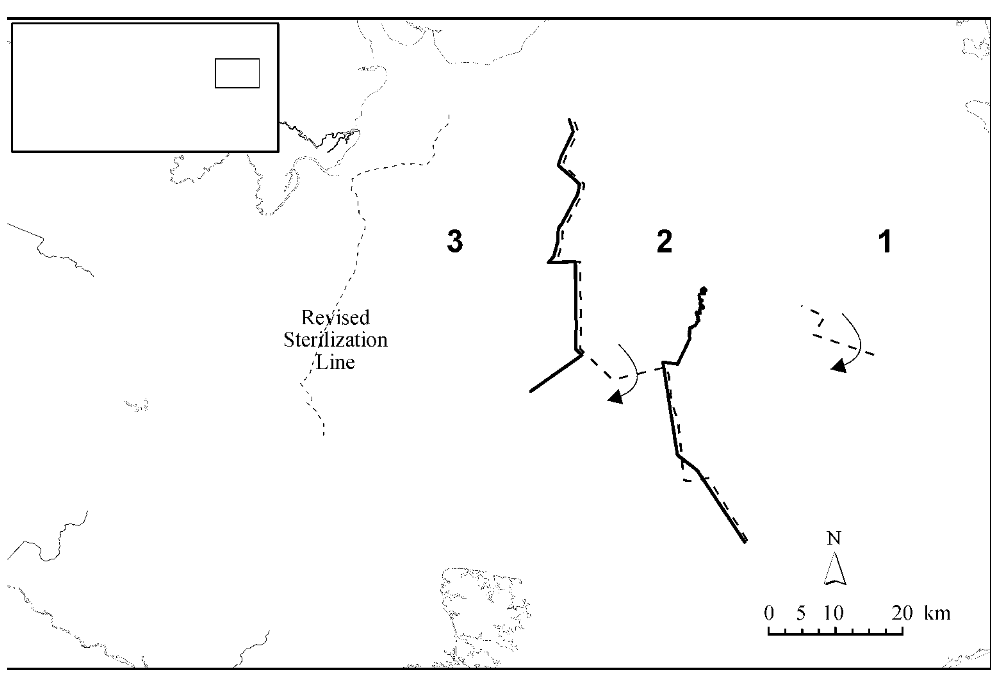

Fig. 1 Historic and current management zones within the red wolf experimental area on the Albemarle Peninsula, North Carolina

In 2002, based on an evaluation of the known spatial distribution of red wolves and non-red wolf canids, the boundaries of the management zones were realigned (dotted lines to solid lines).

tats (Hinton and Chamberlain, 2010; Dellinger et al., 2013). Initially, coyotes were not thought to occupy the experimental population area, but by the early 1990's their presence was documented and shortly thereafter hybridization between red wolves and coyotes occurred (Phillips et al., 1995, 2003; Adams et al., 2003; Adams, 2006). In 1999, a population and habitat viability assessment recognized several threats to establishing a free-ranging red wolf population (Kelly et al., 1999), and the group acknowledged hybridization with coyotes was the greatest risk to recovery of the species. Subsequently, the USFWS adopted a Red Wolf Adaptive Management Plan (RWAMP) to reduce or eliminate this threat (Kelly, 2000).

By its very nature, an adaptive management plan incorporates new or modified procedures as new information becomes available. Such changes in procedures, as well as the amount and geographic distribution of effects, precludes a rigorous quantitative approach, however, we have documented and evaluated the actions taken and their effectiveness. Here we review the results of management actions for the red wolf ARNWR experimental population area from 1993–2013 by evaluating: (1) the numbers of wolves, coyotes, and hybrids captured and monitored each year, (2) the numbers of territorial social groups with presumed breeding capabilities, (3) the number of red wolf and hybrid litters documented each year, and (4) the degree of coyote introgression into the wild red wolf gene pool. If the RWAMP was successful at controlling hybridization and facilitating recovery, we expected (1) an increase in the number of red wolves and the number of canid territories controlled by red wolves, (2) a decrease in the number of hybrid and coyote-like animals occupying the recovery area, (3) more red wolf litters than hybrid litters and a decline in the proportion of hybrid litters over time, and (4) < 10% introgression of coyote ancestry into the wild red wolf population. These results are examined for their implications concerning the future of red wolf recovery, and more broadly, other conservation efforts facing the challenge of hybridization.

1 Materials and Methods

1.1 Field methods

This study occurred within the Red Wolf Recovery Experimental Population Area on the Albemarle Peninsula in northeastern North Carolina (Phillips et al., 2003; Dellinger et al., 2013). During 1993 to 2013, USFWS personnel used padded foot-hold traps to capture all adult (> 9 months old) red wolves, coyotes, and hybrids. Prior to implementing the RWAMP, management efforts concentrated on capturing, radio-collaring, and radio-tracking as many red wolves as possible. In addition, biologists attempted to locate dens and mark pups with microchip "PIT" tags for future identification during subsequent capture operations. At the request of landowners, red wolves were removed from areas where they were not wanted and released at other locales. Coyotes were removed and euthanized when they were encountered.

Conceptually, the RWAMP partitioned the Peninsula into three management zones (Fig. 1), with the most intensive efforts initially deployed in the eastern-most zone and progressing successively westward (Stoskopfet al., 2005). The goals for the eastern-most zone (Zone I) were to radio-collar and release all red wolves, and to remove all coyotes and hybrids. In Zone II the goals were to radio-collar and release all red wolves, and either remove or sterilize (via tubal ligation or vasectomy) and release all coyotes and hybrids at their points of capture. Surgical procedures were performed by a licensed veterinarian following methods described in Seidler and Gese (2012). These sterile animals were left as "placeholders" to defend and maintain their territories (Bromley and Gese, 2001; Seidler and Gese, 2012) with minimal risk to the red wolf gene pool before being removed when there were dispersing red wolves seeking to establish territories, or a red wolf naturally displaced a placeholder. In the remainder of the area (Zone III), Zone II management activities were opportunistically extended westward as resources allowed. In theory, creating a functional red wolf population occupying the entire Albemarle Peninsulawould ultimately saturate the landscape and naturally exclude immigrating coyotes (Kelly, 2000).

Field personnel located radio-collared animals via ground and aerial telemetry every 3- to 7-days to define home ranges and territorial limits, and locate mortalities and identify causes of death. Personnel conducted field surveys to identify areas occupied by unknown canids, translocated red wolves from areas where landowners objected to their presence, located dens to collect samples for genotyping pups, and cross-fostered red wolf pups from captivity to wild parents to augment wild productivity particularly after removing a hybrid litter (cf. Kitchen and Knowlton, 2006). The radio-telemetry data was also used to estimate the proportion of the recovery area occupied by red wolf territories (see online supplemental). Scat sampling for DNA analyses, coupled with location data, was intermittently applied to

provide additional information concerning the genetic characteristics and distribution of canids without capturing and handling animals (Adams et al., 2003, 2007; Adams and Waits, 2007; Bohling, 2011).

1.2 Species identification methods

We defined a red wolf as an individual whose genealogy could be traced directly to the 14 captive red wolf population founders (see online supplemental), or an individual whose genotype contained no coyote-specific alleles and was classified as red wolf using a maximum likelihood assignment test (Miller et al., 2003; Adams, 2006). The genetic assignment test uses a maximum-likelihood approach to compare the genotype of an unknown individual to the allele frequencies of the red wolf founders (with modeled drift) and North Carolina coyotes using 18 nuclear DNA microsatellite loci (Miller et al., 2003). This test considers allele frequency differences, as well as the presence of coyote-specific alleles, which are absent in the red wolf founders but observed in the current coyote population in northeastern North Carolina. Results from the genetic analyses were integrated with data on morphology and parentage to determine whether to retain, sterilize, or euthanize an individual (Stoskopf et al., 2005; Adams, 2006). To be retained in the wild population, animals originally had to have at least 75% red wolf ancestry (Stoskopf et al., 2005). This threshold was raised to ≥ 87.5% red wolf ancestry in 2002. The percentage of red wolf ancestry for each individual was determined in two ways: directly based upon a genetically reconstructed pedigree (e.g., 75% red wolf female x 100% red wolf male = 87.5% red wolf offspring, Adams, 2006) and, in cases where parentage is unknown, from the maximum-likelihood assignment test (Miller et al., 2003). Pedigree analysis methods are described in more detail in online supplemental. For our 2014 sample of known red wolves, 100% can be placed into the pedigree, and the percentage of ancestry that can be traced to the red wolf founders and the proportion of coyote introgression are estimated from the pedigree.

1.3 Assessment of progress

Our assessment of population numbers relies on the number of radio-collared canids ≥ 5 months old known to be alive on 1 March and 1 September each year, 1993–2013. Individuals not identified as being alive on or after specific inventory dates were subsequently censored after that date. By design, the RWAMP was flexible and adaptive (Kelly, 2000). Consequently, we provide results from a management process in which data interpretations are confounded by changes in procedures as well as changes in the geographic distribution of efforts. An example is the more stringent criteria adopted for genetically discriminating between red wolves and hybrids in 2002 (Miller et al., 2003), forcing re-evaluation of all current and former animals in each management zone. Also in 2002, based on an evaluation of the known spatial distribution of red wolves and non-red wolf canids, the boundaries between zones were moved westward, enlarging Zone I and decreasing the size of Zone III (Fig. 1; Stoskopfet al., 2005). Results and interpretations that follow are presented in accord with the zone boundaries recognized in 2007 rather than those accepted at times during which specific management actions were taken. Similarly, the more conservative assignment of genetic ancestry, based on microsatellite genotyping adopted in 2002, is used for animals from all years.

2 Results

2.1 Summary of population management

In the 6 years preceding adoption of the RWAMP, the average number of canids captured for the 1st time ("1st captures") was about 28 per year, and most (75%) were retrospectively identified via genetic analysis as being red wolves (Table 1). During 1999–2013, the number of first captures averaged 63.5 per year, but during this time the proportion of red wolves declined and that of coyotes increased (Table 1).

Table 1 Numbers, by genetic assignment, of adult canids captured for the first time on the Albemarle Peninsula, North Carolina, during four periods, 1993 through 2013

Period	No. canids captured	Mean No. captures/yr.	Mean No. by genetic assignment (%)		
			Red wolf	Hybrid	Coyote
1993–1998[1]	167	27.8	20.8 (75)	2.8 (10)	4.2 (15)
1999–2000[2]	129	64.5	40.5 (63)	16.5 (26)	7.5 (11)
2001–2002[3]	87	43.5	26.5 (61)	10.0 (23)	7.0 (16)
2003–2013[4]	735	66.8	22.6 (34)	10.1 (15)	34.1 (51)

[1] Prior to adoption of RWAMP. [2] Post-adoption of RWAMP relying on physical characteristics. [3] Initiation of reliance on genetic testing. [4] Full implementation of genetic testing of all canids.

Prior to adoption of the RWAMP, the number of canids (> 5 months of age) removed from the Peninsula averaged 11.2 per year (6.5 red wolves, 1.0 hybrids, and 3.7 coyotes; Fig. 2A). Red wolves were primarily removed to accommodate landowners, to initiate breeding on island populations and to establish a second release site in the Great Smoky Mountains National Park. Following implementation of the RWAMP, 13–63 ($\bar{x}$ = 28.2) canids were removed per year. As the years progressed, the genetic classification of animals that were removed changed, with red wolf captures declining and numbers of hybrids and coyotes removed increasing dramatically (Fig. 2A). The high incidence of red wolves removed in 2000 and 2001 (12 and 11, respectively) occurred while management efforts increased substantially but prior to implementing use of genetic criteria for assessing ancestry. Between 2004 and 2013, the number of red wolves removed declined while the removal of animals with coyote ancestry increased (Fig. 2A).

No animals were sterilized prior to 1999, but after that 252 animals were sterilized and released, including 3 red wolves inaccurately classified as hybrids before genetic testing (Fig. 2B); 35 of these occurred in the

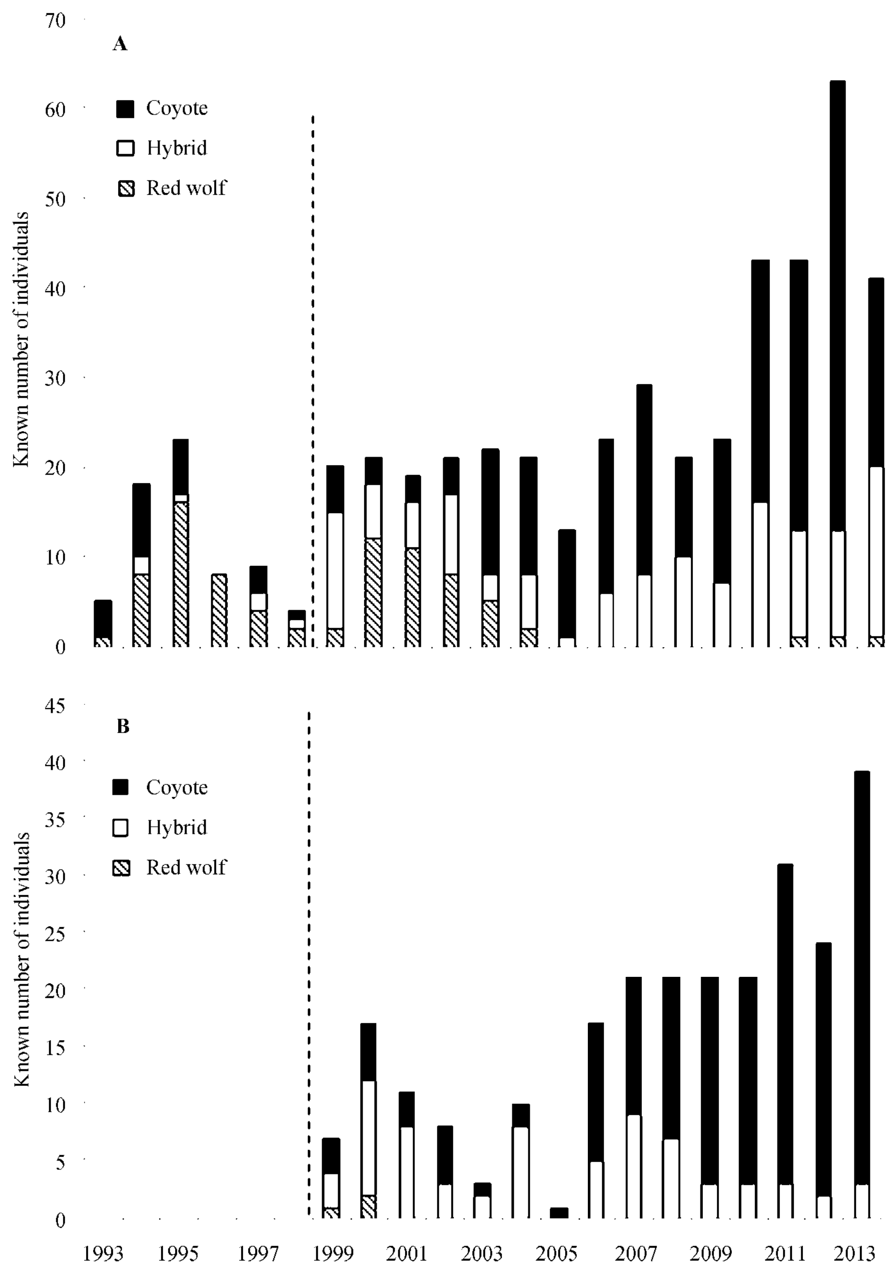

Fig. 2 Numbers of canids (A) removed,and(B) sterilized and released, by genetic classification and year, within the red wolf experimental area, Albemarle Peninsula, North Carolina, 1993–2013

Vertical lines represent initiation of the Red Wolf Adaptive Management Plan.

first 3 years of the RWAMP. The number sterilized was relatively small (1–10 per year) between 2003 and 2005. In 2006 as efforts increased toward the west, 17 animals were sterilized. During 2007–2013, an increasing number of coyotes were sterilized to serve as "placeholders" to hold space on the landscape and prevent genetic introgression (Fig. 2B). Many of these sterilized animals were eventually removed from the population (n = 19) when red wolves appeared to be seeking new territories in areas occupied by sterile animals. In addition, many of these sterile animals were naturally displaced (n = 50) by red wolves.

Other types of management actions were sporadically employed. An additional 41 wolves born in captivity or on island propagation sites were released within the experimental population area, 29 prior to 1999 and 12 afterwards. Between 1999 and 2013, 27 captive-born red wolf pups were cross-fostered into wild litters to augment wild recruitment and enhance genetic diversity after removing a hybrid litter. All cross-fostered pups were accepted by the wild, surrogate parents and at least seven became breeders responsible for 98 red wolf pups born from 2004 to 2013 (A. Beyer, USFWS, unpubl. data).

2.2 Canid population demography and social groups

Sixty-three red wolves (32 adults and 31 juveniles) were released on the Alligator River National Wildlife Refuge (within Zone I) between 1987 and 1994 (Phillips et al., 2003). Fourteen of the releases (11 adults and 3 juveniles) were considered successful and breeding was documented in the wild. Our initial census indicates 33 red wolves known to be present in March 1993 (22, 8, and 3 in Zones I, II, and III, respectively; Fig. 3A). Between 1993 and 1998, 125 additional red wolves > 5 months of age ($\bar{x}$ = 20.8 annually) were captured (Table 1), with the spring 1999 census indicating 52 red wolves within the experimental area (22, 18, and 12 in Zones I, II, and III, respectively; Fig. 3A). During the same 6-year period, 43 red wolf litters were located.

In the first 2 years after implementation of the RWAMP, 81 additional red wolves were captured, plus another 303 red wolves in the ensuing 13 years. Despite the large number of potential recruits to the population, in the next 3 years the census of known living red wolves only increased to 85–90 ($\bar{x}$ = 86.7) animals in the fall, with slightly lower numbers ($\bar{x}$ = 77.0) in spring (Fig. 3A). Thereafter, the known number of free-ranging red wolves across the recovery area has remained relatively stable at around 90–95 adult red wolves.

The relative distribution of red wolves on the landscape changed over time. Both the number of wolves (Fig. 3A) and the number of social units in Zone I declined to about half after implementation of the RWAMP (Fig. 3B), without evidence that hybrids and/or coyotes had appropriated those territories. In Zone II, known numbers of red wolves increased from around 30 to perhaps 50, while an increase from 15 to 25 occurred in Zone III (Fig. 3A).

Coyotes have increased in numbers of first captures (Table 1), numbers removed (Fig. 2A), and numbers sterilized (Fig. 2B) during the recovery effort. During inventories for all intact canids on the Albemarle Peninsula, most coyotes captured and identified were removed and were not alive at our inventory dates, or were sterilized and released. Coyotes were routinely removed in small numbers during the pre-RWAMP period (Fig. 4B) with an increasing number of coyotes being removed throughout the recovery area. Only sterile coyotes were documented in our inventories; intact coyotes were removed. Since 2009, extensive trapping efforts in Zones II and III have resulted in removal of 15–41 ($\bar{x}$ = 24.0) coyotes annually (Fig. 4B). The attempt to capture and genotype all *Canis* on the Peninsula, starting in 1999, resulted in a dramatic surge in the number of hybrids removed, principally in Zone II (Fig. 4A). Additional hybrid individuals were regularly removed, mostly in Zones II and III. Another surge in hybrid removal followed adoption of the more stringent genotype criteria in 2002, resulting in removal of 9 hybrid individuals, including 7 within Zone I (Fig. 4A). Subsequently, the number of hybrids removed declined erratically (Fig. 4A) with surviving individuals being removed from Zone I and increased removals from Zones II and III.

The number of recognized red wolf social groups increased from 5 in 1993 to 14 by 1999 (Fig. 5D). Subsequently, this increased to about 20 social units between 2003 and 2008 (Fig. 5D) and then declined to about 15 social units during 2009 to 2013 as breeding pairs have been disrupted by gunshot mortalities associated with coyote hunting in the recovery area during the past several years (USFWS, 2009–2013). In Zone I, the number of social units increased from 4 in 1993 to 10 by 2001, where it remained through 2003 but then dropped to 5 by 2005, and subsequently declined to 2 breeding units during 2011–2013 (Fig. 5A). The change in known numbers of desirable social units in Zone II from one in 1993 to 10 in 2004 was associated with an intermediate shift to "neutral" social units associated with the sterilization of one or both alpha animals (Fig. 5B). The

known number of wolf social units in Zone III was relatively stationary (12) until implementation of the RWAMP. As in Zone II, it appears the use of sterilization assisted in an increase to 5–6 social units with desirable red wolf ancestry (Fig. 5C).

2.3 Summary of genetic results

As the number of radio-collared animals increased, so did the location of natal dens (8.5/yr before RWAMP adoption to 12.6/yr afterward). Genetic assessment of litters indicated the number of hybrid litters fluctuated over time (0–5/yr) with an average of 1.5/year (Fig. 6). The number of red wolf litters per year was always higher than the number of hybrid litters and averaged 6.9/year (Fig. 6). The ratio of hybrid to red wolf litters

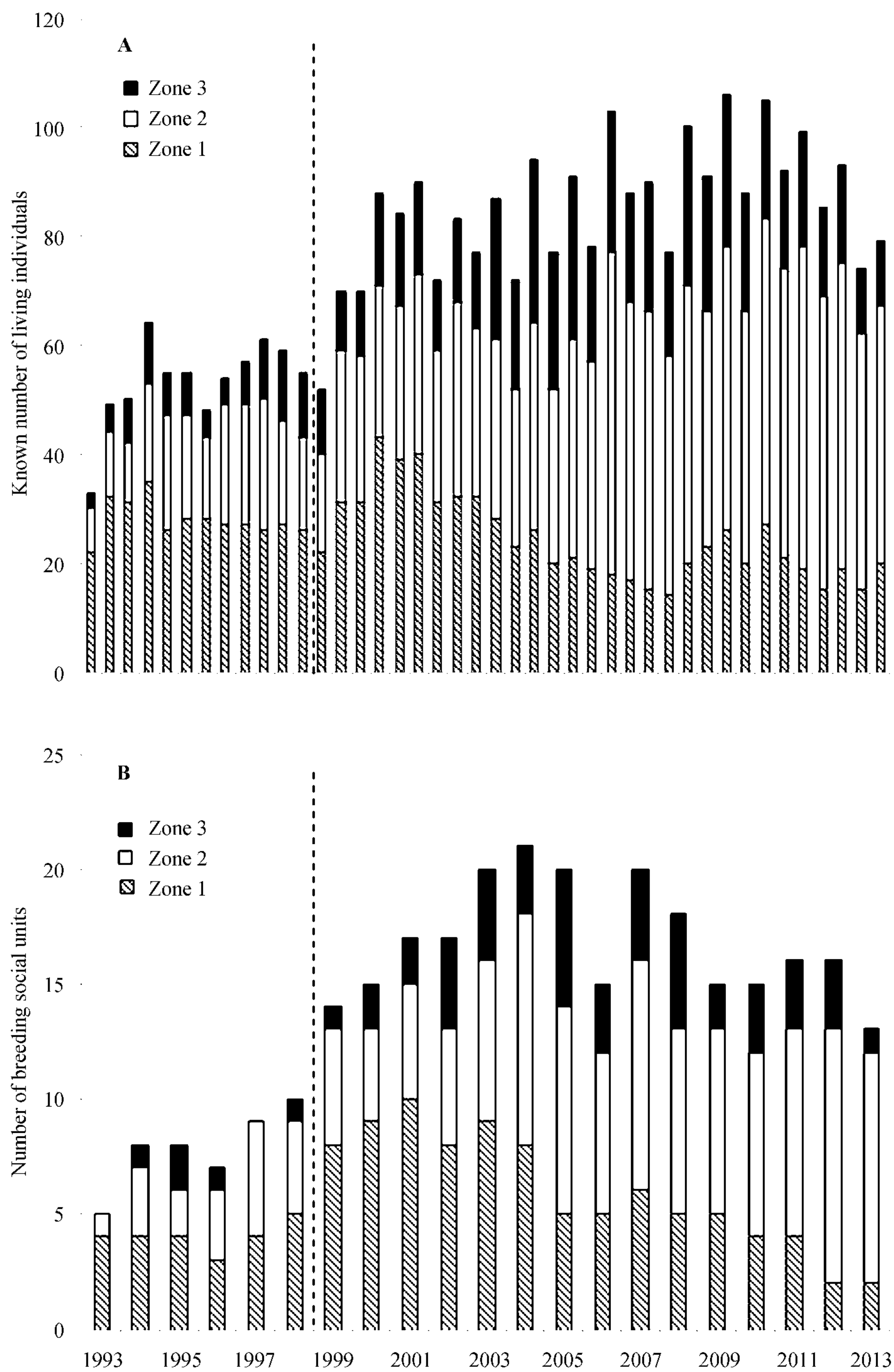

Fig. 3 Known numbers and distribution of (A) red wolves during spring (March 1st) and fall (September 1st) inventories, and (B) known red wolf social units in spring, among management zones within the red wolf experimental area on the Albemarle Peninsula, North Carolina, 1993–2013

Vertical lines represent initiation of the Red Wolf Adaptive Management Plan.

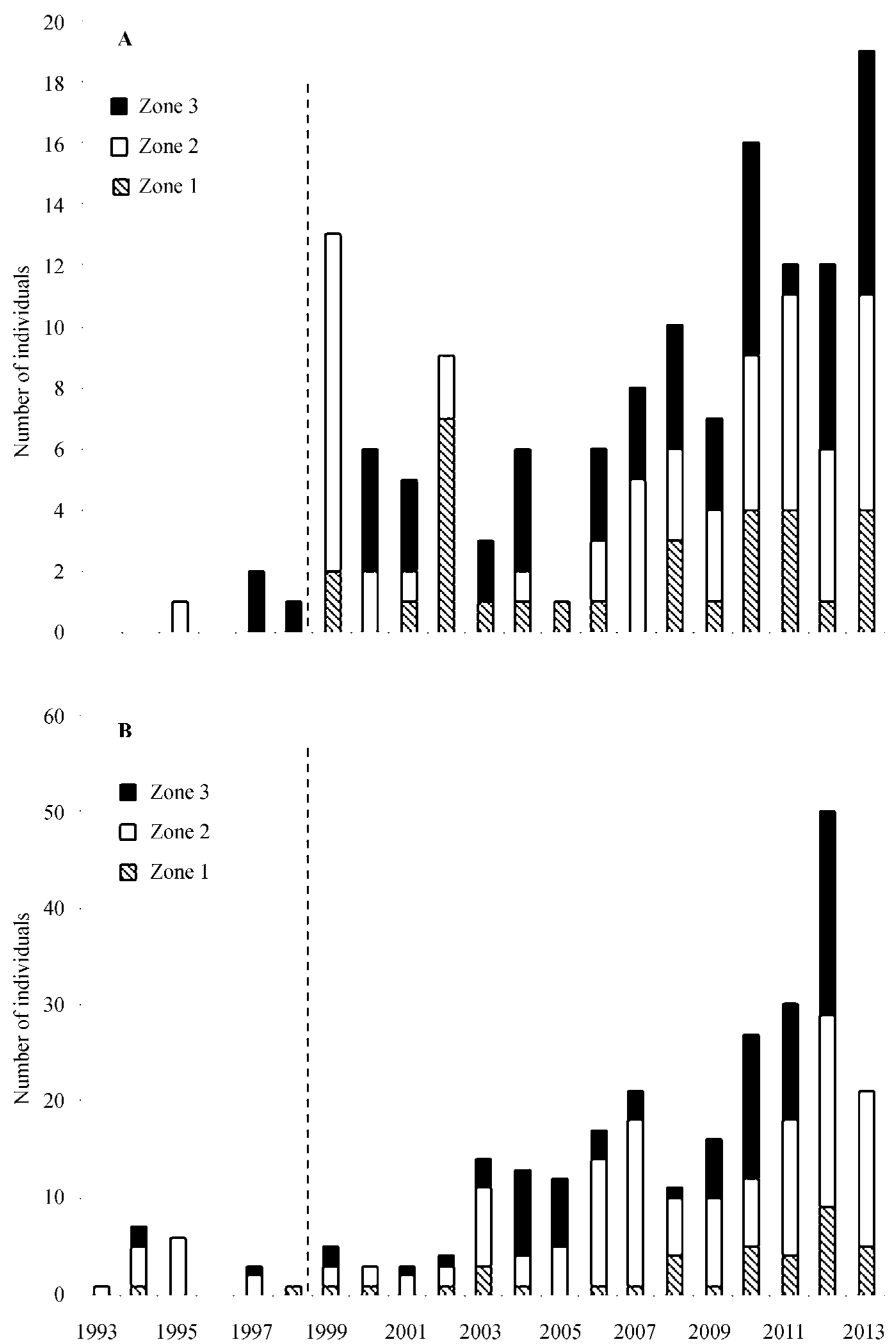

Fig. 4 Numbers of (A) hybrids removed, and (B) coyotes removed, by zone and year, from the red wolf experimental area on the Albemarle Peninsula, North Carolina, 1993–2013

Vertical lines represent initiation of the Red Wolf Adaptive Management Plan.

averaged 21% and peaked at 55% in 2006 (Fig. 6). Overall, 37 of the 40 (92.5%) litters with coyote ancestry were detected and removed, while 7 of 147 (4.8%) red wolf litters were mistakenly removed before genetic testing.

Retrospective molecular genotyping suggested the known number of free-ranging reproductively-intact hybrids alive at any inventory point in the pre-RWAMP period never exceeded two. No reproductively-intact hybrids were noted at any inventory date from 2004 through 2013 (i.e., all known hybrids were removed or sterilized). The average ancestry of all known, reproductively intact red wolves and introgressed individuals in the recovery zone in 2014 is 96.5% based on genetic testing and pedigree analysis.

3 Discussion

3.1 Success of current program

Minimizing the threat of hybridization for threatened and endangered species is particularly challenging when

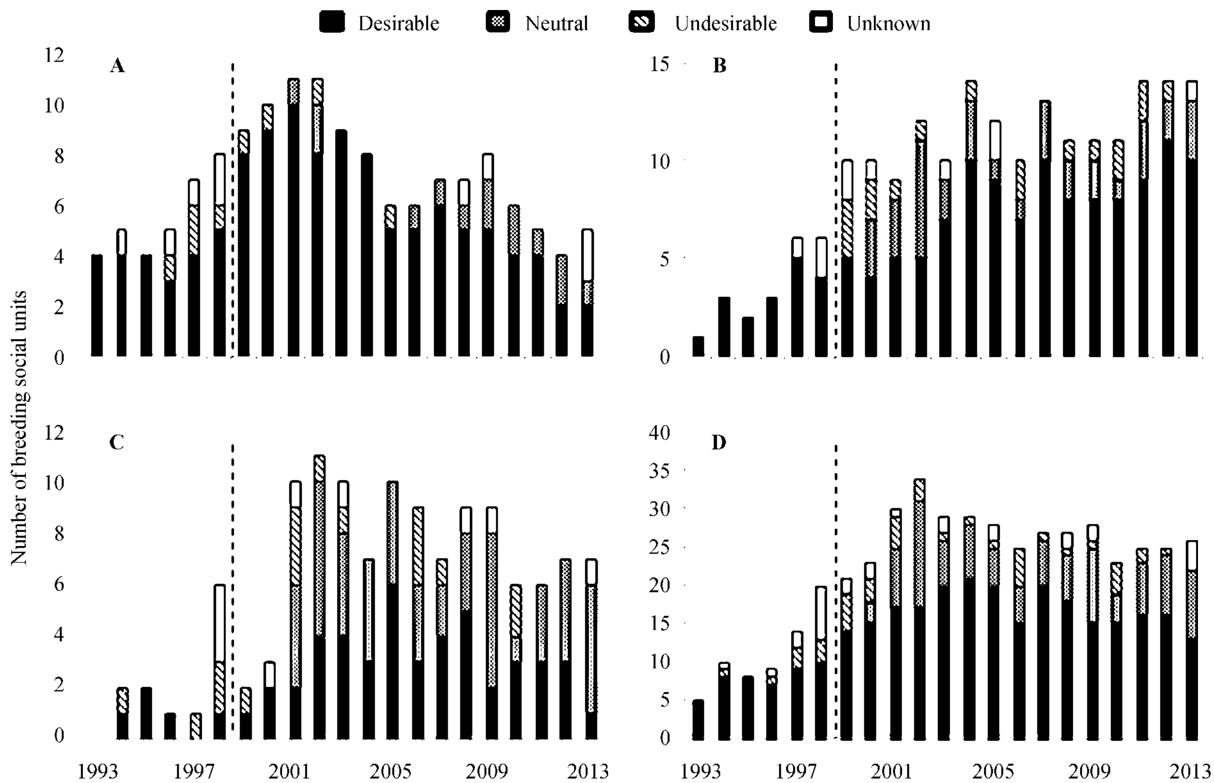

Fig. 5 Numbers and suitability of canid social units in Zones (A) I, (B) II, and (C) III, and (D) the entire red wolf experimental area, Albemarle Peninsula, North Carolina, 1993–2013

"Desirable" indicates the alpha male and female individuals are ≥75 % red wolf ancestry; "neutral" indicates one or both alpha individuals are sterile; "undesirable" indicates both breeding individuals are reproductively intact and one or both are genotypically identified as coyote or hybrid; and "unknown" indicates that the genotype of one individual of the breeding pair is unknown. Vertical lines represent initiation of the Red Wolf Adaptive Management Plan.

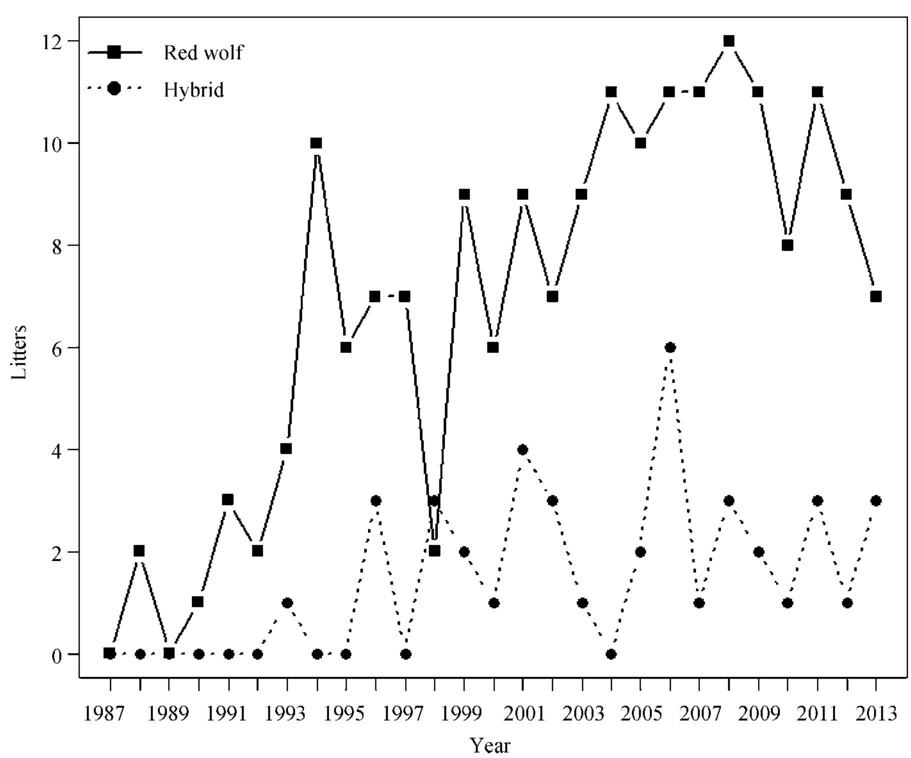

Fig. 6 Number of red wolf and hybrid litters detected each year since the reintroduction of red wolves into North Carolina

the hybridizing species greatly outnumbers the threatened population (Allendorf et al., 2001) as with red wolves and coyotes in North Carolina. The success of the RWAMP at controlling hybridization and facilitating red wolf recovery was mixed, based our criteria. The number of red wolves did increase over time but plateaued around 2009 and declined slightly thereafter. The number of coyotes and hybrids detected did not decrease over time as desired. Despite predictions of genetic swamping (Kelly et al., 1999; Fredrickson and Hedrick, 2006), our estimate of average ancestry of all known, reproductively intact red wolves and introgressed individuals in the recovery zone in 2014 is currently 96.5% indicating the success of the RWAMP at limiting introgression of coyote genes into the reintroduced population. We also documented more red wolf litters than hybrid litters, but the ratio of hybrid litters to red wolf litters did not decline over time indicating hybridization is an ongoing challenge.

The RWAMP is an intensive long-term management effort that includes removal of coyotes and hybrids, sterilization and release of others to control space (i.e., the "placeholder" concept), the release of red wolves from captive-breeding programs, genetic testing of litters, cross-fostering captive born pups to wild parents, and a public relations effort to promote the recovery program and reduce anthropogenic mortalities. It is difficult to speculate about the relative contribution of individual activities, but we consider the removal, as well as sterilization and release, of coyotes and hybrids as critical components. Another key management activity has been the genetic testing of wild born litters to provide the opportunity to remove hybrids before they reach breeding age. Although such activities were not a part of the original recovery effort, they now constitute a core component of the program, and in the absence of such efforts it seems unlikely that introgression of coyote genes into the red wolf population could be adequately controlled (Fredrickson and Hedrick, 2006). We recognize the potential biases of monitoring hybridization based on capture efforts alone and suggest complementary, non-invasive sampling of scats (Adams and Waits, 2007; Bohling and Waits, 2011) to assess the genetic composition and distribution of canids. In 2010, this type of analysis was conducted in the recovery area and revealed that 1) only 4% of samples had hybrid ancestry, and 2) red wolf ancestry was highest in zone 1 (> 80%) and decreased from East to West (Bohling, 2011) consistent with results from the trapping efforts presented here.

3.2 Implications for future management of red wolves

The U.S. Fish and Wildlife Service continues to actively promote recovery efforts of the red wolf in eastern North Carolina (USFWS, 2007; Hinton et al., 2013). These efforts are consistent with the conclusion that we should "protect the red wolf as a component of the evolutionary legacy of canids" (Allendorf et al., 2001), and recent analyses of North American canids indicating this species has a distinct genetic signature (VonHoldt et al., 2011; Rutledge et al, 2012b). We acknowledge that these efforts have required considerable financial and social investments each year (USFWS 2013), and the population is not self-sustaining. In theory, efforts to remove or sterilize coyotes might be relaxed with time as red wolves fully occupy available habitat within the recovery area. Under such conditions, wolves dispersing within the recovery area would be successful in finding conspecific mates and coyotes immigrating to the area would be naturally excluded by resident wolves (Murray and Waits, 2007; Roth et al., 2008; Wheeldon et al., 2010). However, we believe this scenario is unlikely because wolf habitat is discontinuous within the recovery area and anthropogenic habitat changes will continue to favor coyotes because of their ability to more effectively colonize landscapes in closer proximity to human activity (Benson et al., 2012; Gese et al., 2012; Benson and Patterson, 2013). Further, there is little evidence red wolves naturally control the coyote population through strife, which is a core prediction derived from the competitive exclusion hypothesis (Murray et al., 2015). However, it is notable that recent records also report gunshot mortality remains prevalent for coyotes, indicating that mistaken identity by coyote hunters could continue to disrupt red wolf breeding pairs. Yet, a recent legal ruling banning coyote hunting in the recovery area (Red Wolf Coalition et al., v. Cogdellet al., No. 2:13-cv-60-BO, 2014 WL 1922234 [E.D. N.C. May 13, 2014]) may help promote stability of red wolf social groups.

While the wolf population had a relatively high baseline mortality risk relative to other wolf populations (Fuller et al., 2003; Smith et al., 2010) and the majority of deaths were related to anthropogenic activities, it does not appear the additive nature of human-related mortality exceeds that observed in other wolf populations (Creel and Rotella, 2010; Murray et al., 2010; Sparkman et al., 2011). However, anthropogenic mortality can lead to increased hybridization in other canid systems (Rutledge et al., 2012a). In red wolves, over half of the detected hybridization events followed the

disruption of a stable breeding pair of red wolves due to mortality of one or both breeders (Bohling, 2011). Of these 69% were due to anthropogenic causes, primarily gunshot mortality during the local fall hunting season, which occurs just prior to the red wolf breeding season (Bohling and Waits, press).

The number of known wolves appeared to plateau at around 90 to 95 adult red wolves, indicating the population may have reached carrying capacity, as also suggested by Murray et al. (2015). In 2007, red wolf social units were using about 1,043 km^2 – about 48% of "usable" (cumulatively used) habitat and about 23% of the total recovery area (USFWS 2007, online supplemental), but the remainder of acceptable habitat is fragmented in small patches located across the recovery area and less likely to be colonized by wolves given recent habitat studies (Dellinger et al., 2013). In addition, we consider expansion of the red wolf population beyond the current recovery area unlikely given recent survey results showing few red wolves in adjacent areas (Bohling and Waits, 2011). The current USFWS recovery goals require establishing 3 independent populations (USFWS, 1989), and such efforts would require a rigorous assessment of red wolf habitat availability, combined with empirical and modeling analysis of coyote abundance and potential hybridization, in candidate recovery areas. If reintroduction efforts are initiated in new geographic areas, the management actions for controlling hybridization described here will likely be critical to success as most of the historical red wolf range is now occupied by coyotes. Given the extensive loss of habitat and the challenge of hybridization with invasive coyotes, the red wolf is a species fitting the definition of "conservation reliant" (Scott et al., 2005), and the ongoing program review should be considered an opportunity to chart a new direction that reflects the changing standards and expectations regarding endangered species recovery (Scott et al., 2010; Jackowski et al., 2014; Murray et al., 2015).

3.3 Implications for other species

Our assessment suggests that access to appropriate resources can curtail or reverse genetic introgression in some situations. Our data indicate the use of sterilization and the removal of hybrids to limit introgression of unwanted coyote genes has enhanced effectiveness of red wolf recovery efforts. Red wolves are relatively long-lived, territorial, form social hierarchies, and develop strong and persistent social bonds. This enables the use of sterile individuals of the introgressing species and hybrids to control space without compromising the status of the target species. In our case the introgressing species, the coyote, is abundant and adaptable to human-modified landscapes. While procedures similar to those used in the RWAMP might work in the case of European gray wolves or Ethiopian wolves *Canis simensis*, there could be additional social conflicts because domestic dogs represent the introgressing species. Perhaps more realistically, the population of eastern wolves in Algonquin Provincial Park (Patterson and Murray, 2008) ultimately may benefit from removal of hybrids occurring in the same region, especially given the unique genetic and taxonomic status of wolves inside the park (Rutledge et al., 2010). Similar considerations might apply for conserving the European wildcat *Felis silvestris*, with the added caveat that felids may not have as persistent social bonds and strong territorial constraints common among many canids, thereby precluding some of the measures enacted in North Carolina to protect wolves. Reduced social fidelities among cervids (e.g., red deer *Cervus elaphus*), or among aquatic species, may reduce the utility of such efforts.

An important contribution of the RWAMP has been to help elucidate mechanisms of hybridization affecting recovering populations, and to test methods of managing such hybridization to improve chances of recovery success (Murray and Waits, 2007). Another novel management method used for red wolves that might be beneficial in other systems is the genetic testing of litters to remove hybrid individuals and cross-fostering pure offspring from captivity to increase recruitment into the wild population. Aggressive management actions designed specifically to undermine the negative influence of invasive species can enhance population recovery efforts (Peterson et al., 2008; Finlayson et al., 2010), at least over the short-term. Such management, based on intensive and adaptive research, is a much- needed addition for other species threatened by hybridization and introgression (Laikre et al., 2010).

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Supplemental information

Red Wolf Founders

The red wolf founders are the 14 individuals removed from the wild along the Gulf coast of Texas and Louisiana who were chosen, based upon morphology, skull radiographs, sonographic analysis, breeding experiments, and electrophorectic and chromosomal analysis, to initiate the captive breeding program (Carley, 1975; Riley and McBride, 1975). These individuals also have a unique mitochondrial DNA haplotype that has not been observed in coyotes (Adams et al., 2003).

Pedigree Analysis Methods

Pedigree analysis methods are described in detail in Adams 2006, but are summarized here. Parentage was determined using a combination of field and genetic data. USFWS biologists typically identified potential parents of a newly captured red wolf or litter of puppies based upon observational knowledge of breeding pairs and the proximity of the various red wolf packs. Parents were unknown or uncertain for approximately 25% of captured individuals. Genotypic data at 18 microsatellite loci was used to determine parentage relationships using the program Cervus (Marshall et al., 1998; Kalinowski et al., 2007). We used Cervus to identify the most likely parents from the potential pool of reproductive individuals in the population. We allowed a maximum of one mismatch for a potential parent pair, but only if the mismatch was due to allelic dropout. We also checked all parentage assignments with a 1 allele mismatch to confirm that the pairing was realistic based on detailed field observations and/or telemetry of wolves during the breeding season. Fifteen percent of identified parent-offspring relationships had 1 genotypic mismatch; the remainder had zero mismatches.

Red Wolf Pack Territory Estimates

Using data from 1987–2007, wolf pack territory estimates were generated by including data for every known pack member in a 95% kernel density estimation with a root-n bandwidth estimator (Worton, 1989; Wu and Tsai, 2004; Steury et al., 2010). Locations from all wolves (> 75% ancestry) within a pack were combined for home range estimation, although exploratory and emigrant movements were excluded, and more than one location per pack per day was included only if individual wolves were > 500 m apart (Oakleaf et al., 2006). We considered any habitat that had ever been occupied by a red wolf pack between 1987 and 2007 as "usable habitat".

The recovery area encompasses about 4,600 km^2 (not including large water features). From 1987 through 2007 wolf pack territories cumulatively covered a total of 2,172 km^2, or about 47% of the total experimental area. In 2007, red wolf social units were using about 1,043 km^2 – about 48% of "usable" (cumulatively used) habitat and about 23% of the total recovery area (Fig. 1).

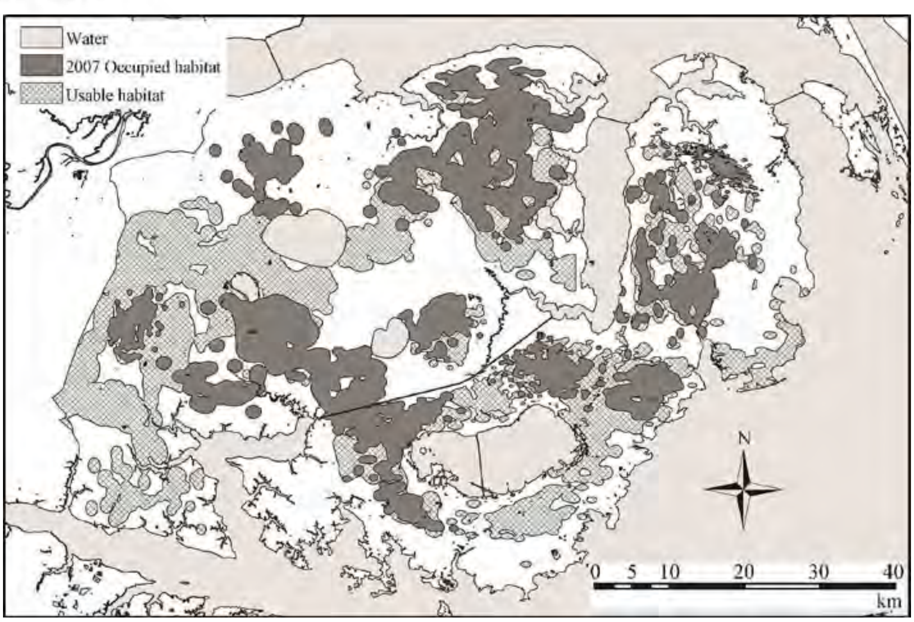

Fig. 1 Availability of red wolf habitat on the Albemarle Peninsula, North Carolina
Usable habitat includes any habitat known to be used by red wolves (1987–2007).

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RED WOLF
(*Canis rufus*)

Population and Habitat Viability Assessment

Virginia Beach, Virginia
13 - 16 April, 1999

Red Wolf

(Canis rufus)

Population and Habitat Viability Assessment (PHVA)

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WORKSHOP REPORT

A Collaborative Workshop:

United States Fish & Wildlife Service
The Conservation Breeding Specialist Group (SSC/IUCN)

A contribution of the IUCN/SSC Conservation Breeding Specialist Group in collaboration with the United States Fish & Wildlife Service.

Kelly, B.T., P.S. Miller, and U.S. Seal (eds.). 1999. *Population and Habitat Viability Assessment Workshop for the Red Wolf* (Canis rufus). Apple Valley, MN: Conservation Breeding Specialist Group (SSC/IUCN).

Additional copies of this publication can be ordered through the IUCN/SSC Conservation Breeding Specialist Group, 12101 Johnny Cake Ridge Road, Apple Valley, MN 55124 USA. Fax: 612-432-2757. Send checks for US$35 (for printing and shipping costs) payable to CBSG; checks must be drawn on a US bank.

Red Wolf

(Canis rufus)

Population and Habitat Viability Assessment (PHVA)

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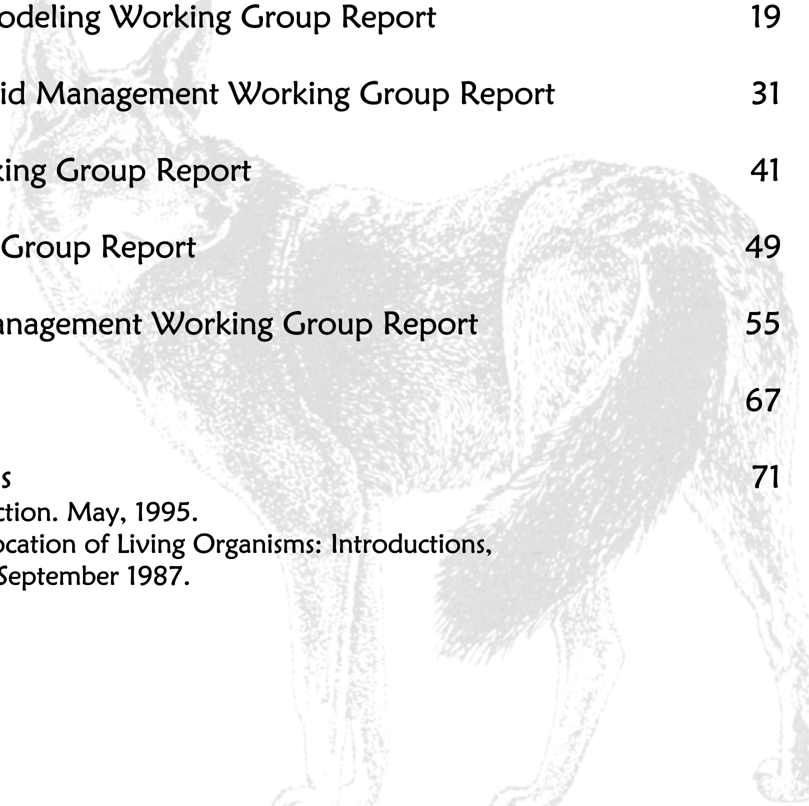

Red Wolf

(Canis rufus)

Population and Habitat Viability Assessment (PHVA)

Virginia Beach, Virginia
13 - 16 April, 1999

Section 1
Workshop Executive Summary

Population and Habitat Viability Assessment (PHVA) for the Red Wolf *(Canis rufus)*: Workshop Executive Summary

Introduction

The red wolf (*Canis rufus*) is one of the most endangered animals in the world. It is a shy species that once roamed throughout the southeast United States as a top predator. Aggressive predator control programs and clearing of forested habitat combined to cause impacts that brought the red wolf to the brink of extinction. By 1970, the entire population of red wolves was believed to be less than 100 animals confined to a small area of coastal Texas and Louisiana. Moreover, genetic swamping through hybridization with coyotes was recognized in the early 1960s by Carley (1975) as a major threat to the survival of this and other remnant red wolf populations. To save the species from extinction, the U.S. Fish and Wildlife Service (Service, USFWS) captured as many as possible of the few remaining animals from 1974 through 1980. Only 14 captured animals met the criteria established to define the species and stood between its existence and extinction. These animals formed the nucleus of a captive breeding program at the Point Defiance Zoo and Aquarium in Tacoma, WA with the final goal of reestablishing the species in portions of its original range. Thirty one zoos and nature centers in 19 states and the District of Columbia now cooperate in a national breeding program and are valuable partners in efforts to restore red wolves to their natural habitat. The red wolf is now back in the wild, hunting, rearing young, and communicating by its characteristic howl, in several locations in its original southeastern habitats, including one mainland reintroduction site, and three island propagation sites. The red wolf was one of the first endangered species to attract recovery attentions from the Service after the passage of the Endangered Species Act on December 28, 1973. An interim recovery team was appointed on August 4, 1974, and in January 1975, it received official sanction by the Service.

The Red Wolf Recovery Program has had significant successes over its history, including but not limited to perpetuation of the red wolf genome in captivity, third generation wild pups, and a population distributed over one million acres. It is vital to perpetuate this success. However, several critical issues challenge the expansion of the program to meet its recovery goals. Primary among these issues are: (1) selection of additional restoration sites, (2) assessing and managing the threat hybridization represents to recovery, (3) the need for an effective and feasible monitoring program, and (4) an assessment of the role of the captive breeding program to facilitate recovery in the wild. Because of the complexity of these issues, external expertise and review from the scientific community was required for the development of effective conservation action strategies. The inclusion of such expertise is consistent with the requirement of the Service's Strategic Plan to base decisions on sound scientific judgement. The Conservation Breeding Specialist Group (CBSG) of the IUCN / World Conservation Union has recognized expertise in facilitated intensive, scientifically rigorous workshops that are designed to generate creative and substantive management recommendations from participants with potentially different viewpoints on the relevant conservation issues. After researching the utility of the CBSG process, the Service decided to host such a workshop, known as a Population and

Habitat Viability Assessment or PHVA, and invite CBSG to facilitate to begin developing solutions focused on the technical issues facing the recovery of the red wolf.

A red wolf PHVA workshop was conducted April 13-16, 1999 in Virginia Beach, Virginia at the Holiday Inn Executive Center. Forty scientific and management experts in the fields of wolf and coyote biology, wildlife biology and management, genetics, captive breeding and population modeling attended this workshop. After brief opening statements by Red Wolf Recovery Program lead biologist Brian Kelly and CBSG Chairman Ulysses Seal, the participants engaged in a process of species conservation issue identification and description. A group of five primary issues were distinguished and selected for further analysis in small groups. These groups were: 1) coyote hybridization/genetic consequences, 2) wild population monitoring, 3) new population site selection 4) captive population management, and 5) risk assessment modeling. The hybridization/genetics group quickly realized that the immediacy and significance of the hybridization threat superceded all other issues. Consequently, this group divided the hybridization concerns into five distinct problems and ranked these problems according to priority. By noon on the second day of the workshop, it was clear that each of the working groups began to focus on hybridization as the primary issue driving discussions on red wolf conservation in the Alligator River region in particular and the southeastern United States more generally. As a result, the other four working groups decided to reorganize and/or restructure their directions for greater emphasis on the issues related to coyote hybridization and its threat to red wolf population viability.

The hybridization/genetics work group was disbanded with former members dispersing into the remaining four groups. The problems articulated by the former hybridization/genetics group were forwarded to the appropriate remaining work groups as the overriding issues for their own consideration. The working group originally discussing new population site selection was renamed the "biological control group" and eventually, through additional synthesis and reformulation, became the "wild canid management" working group. The recommendations arising from each of these working groups are presented below, with more detail to be found in the appropriate working group reports found elsewhere in this Report.

Summary of Working Group Recommendations

Canid Hybridization

While this group met for only one day, the issues they discussed were rapidly seen as paramount to any discussions centered on maintaining the genetic and demographic integrity of the red wolf as we know it today. This realization is reflected in the group's general statement:

> Hybridization that affects the genetic and phenotypic integrity of the red wolf is the primary issue facing its recovery. How we proceed with red wolf recovery is dependent upon how we assess, and if possible, manage hybridization.

Following considerable discussion, the group developed five primary issues into the following statements that helped to guide the deliberation process in the remaining working groups:

- We need to determine the degree of hybridization that can occur without threatening the phenotypic (behavioral, morphological, etc.) or genetic integrity of the red wolf.
- We need to determine how to measure, monitor, and actively manage (e.g. coyote and hybrid control) hybridization levels as determined in the statement above.
- We need to determine the evolutionary context of the red wolf and the role that hybridization played in its evolution.
- We need to determine ways of contending with the political (i.e. degradation of state and local support), social (mutt effect), legal and administrative (lack of hybrid policy within the USFWS) problems.
- We need more experimental data on hybridization. For example the program should include breeding interactions, fitness of hybrids, etc.

Population Viability Modeling

The initial task for this group was the development of demographic models to assess the risk of red wolf population decline and extinction in and around the Alligator River National Wildlife Refuge site. This was to be accomplished using the *VORTEX* stochastic simulation modeling package used frequently by CBSG in PHVA workshops. However, given the participants' refocused emphasis on the threat of hybridization, the group felt that *VORTEX* was inadequate to address the genetic consequences of this process. As a result, attention shifted to the development of a simple genetic model to address the consequences of hybridization from the standpoint of measuring the rate of loss of red wolf "ancestry" – the proportion of the total population genome that can be traced back to the original red wolf stock – as a function of the frequency of hybridization (defined here as the proportion of total litters that are the product of hybrid matings). Preliminary analysis indicates that estimates of the current rate of hybridization – with as many as 20% of recent litters resulting from hybrid matings – are much higher than those allowed under reasonable limits of acceptable loss of ancestry over the next few red wolf generations.

The group recognized the immediate need for additional work on this model to refine it in terms of a number of general characteristics including the need for it to be spatially explicit, and for special emphasis to be placed on the density-dependent nature of red wolf – coyote hybridization.

Biological Control / Canid Management

The primary question facing the newly formed Biological Control/Canid Management Working Group was: how do we manage hybridization to benefit red wolves? The group identified six issues related to this question and then developed recommendations and actions to address them. In addition, this working group put forward a set of specific, innovative management actions and related recommendations for consideration.

- Revise recovery plan according to recommendations from this workshop
- Postpone selection of new reintroduction site and focus effort on Alligator River National Wildlife Refuge (ARNWR) site.
- Consider set of criteria derived from Site Selection Working Group when selecting this new site

- Focus necessary resources on development of a rapid technique for canid identification and develop relationships with a lab(s) willing to do this work
- Implement biological control until we can better understand hybridization management and/or the balance is shifted from coyotes to red wolves.
- Implement the management actions listed above to prevent coyote gene flow from entering the red wolf genome.
- While implementing management actions, collect data needed to test the hypotheses (answer the questions) listed above and ensure that all management actions include methods for evaluation of their success and effectiveness.

Field Monitoring

The charge of the Field Monitoring group was to recommend methods and direction for monitoring free-ranging red wolves. The group considered the relative merits of various manipulations and experimental approaches. The participants felt that the problem of coyote gene introgression into red wolves is so great that it is unwise to utilize any of the NENC (North East North Carolina) recovery area for hypothesis testing. Such hypothesis testing removes some packs from being managed for the primary goal of protecting and promoting the growth of the self-sustaining, non-hybridizing population of red wolves in NENC. Resolution of the data needed to address various null hypotheses is difficult to obtain because of limitations of field work. Conclusions from hypothesis testing will be difficult to draw from small samples, especially considering variability in canid behavior.

- Maximize number of releases to suitable sites to maximize red wolf population growth
- Kill coyotes and non-wolf canids in Dare, Hyde, Tyrrell, Washington, and Beaufort Counties (in that order of priority) with reviewed standard procedures.
- Processing and collaring/recollaring any red wolves captured and then released
- Ongoing assessment to estimate abundance of coyotes
- Lethal control for 6 years (two generations of three years per generation).
- Goal for internal ability to genetically identify canids (blood and scat)
- Assess potential development of hybridization in North Carolina by evaluating past and present status in southeast Texas

General Workshop Statement on the Hybridization Issue

Because of the serious nature of the hybridization issues related to red wolf conservation, and the differences in approach to coyote management taken by the Biological Control and Field Monitoring working groups, an ad-hoc group was formed to draft a joint statement on the hybridization issue and the need for its management:

> The Red Wolf Recovery Program has had significant successes over its history, including but not limited to perpetuation of the red wolf genome in captivity, third generation wild pups, and a population distributed over one million acres. It is vital to perpetuate this success. However, hybridization in the free-ranging population has been recognized as a serious threat to the continued success of this landmark program. Because of this threat, our primary recovery focus must be protecting and promoting the growth of a self-sustaining, non-hybridizing population of red wolves in the wild and sustaining an active captive component. Actions to be taken will use an adaptive management approach that will not compromise the ability to achieve this goal.

New Population Site Selection

This working group first addressed the question of whether or not this is the right time to select a new site. It was determined that development of criteria and rationale for those criteria would be beneficial even if the decision to choose a new site is postponed. Ultimately, the group concluded that this is not the best time to devote resources to new population site selection and re-formed with new responsibilities targeted at addressing the worsening threat of coyote hybridization. However, before disbanding, the group outlined the following broad recommendations:

- Current resources should be focused on acquiring information on conditions that will assure red wolf genetic stability.
- Determine if wolves can maintain themselves in presence of coyotes.
- Revise recovery plan based on current knowledge about the apparent threat of hybridization. Specifically consider the following: 1) the 170,000-acre requirement is unrealistic; 2) intensive management of various sorts will be required; 3) red wolves may need to be put outside historic range.
- Form Recovery Plan revision team and reassess Recovery Plan within the next year.

Captive Population Management

One fact became clear early in this PHVA workshop – that the role of the captive population in the recovery of red wolves had not diminished, but was becoming even more important than ever before. The hybridization of free-ranging red wolves with coyotes means that the captive population is the only repository of the original genetic composition of the species. Therefore, it was recognized that continued infusions of captive-bred wolves into the wild would be necessary to maintain hybrid-free populations of red wolves in the wild. As a result of the PHVA process, increased breeding of the captive populations and expansion of spaces for red wolves in zoos and other captive facilities has emerged as a critical need.

The Captive Population Management working group developed the following set of recommendations:

1. Maintenance of an independent captive population

- Recruit additional cooperators targeting the historic range (emphasize the multiple roles of the captive population; further promote re-introduction program)
- Increase number of spaces at current facilities (new holding areas or restructure current holdings) – quality of space/exhibits may differ depending on the long term need of specific animals
- Maintain current facilities by surveying cooperators and targeting their program focus (e.g. breeding, research, outreach and education)
- Increase number of breeding recommendations per year; reproductive evaluations of individuals in unproductive pairs or those with low reproductive success (including fecal hormone analysis of males and females and semen analysis); examine husbandry, nutritional and environmental factors that could affect reproduction; increase space to accommodate increased production, consider culling as an option to increase space for stabilizing the population; be sure reproductive organs are included in necropsy protocol;

look at past records to see if past hormone implant contraception may be contributing to lowered fertility.

- When males have similar mean kinship values, recommend the older animal for breeding; recommend separating sexes rather than MGA for contraception, so institutions should have facilities for separating sexes; continue to investigate the development of safe, effective and reversible contraceptives.
- Continue on-going research on semen freezing and timing ovulation;
- Develop a Genome Resource Bank (GRB) action plan that would also include serum, tissue samples and cell lines from the wild and captive population;
- Determine how much sperm from which individuals is banked, including data on post-thaw motility, bring this information to the Masterplan meeting and use it in population genetic modeling with *GENES* to evaluate effects on genetic diversity;
- Identify a central location to house samples; funding is in place for the reproductive research portion of this initiative.
- Maximize increase of gene diversity when picking breeding pairs

<u>2. To supply wolves needed for release to augment wild population where and when appropriate.</u>

- When wolves are requested for re-introduction: chose wolves for re-introduction that are under-represented in the wild; include this need when making breeding recommendations in the Species Survival Plan (SSP) master plan when possible; continue as a priority for the islands or mainland to set up pairs of under-represented animals to produce offspring for release; monitor survival and reproduction of re-introduced animals to track any contributions to increasing gene diversity.
- Produce sufficient numbers of wolves in captive or island facilities for release (transferred animals responsibility of USFWS)
- Give wolves experiences such as: opportunities to hunt, live in a social group, introduce at a young age so they have less time in captivity, minimal contact with humans, experience with raising young or having reproduced themselves, and reared in larger, diverse enclosures; monitor after release to assess survival.

<u>3. Research to investigate hybrid problems and questions.</u>

- Examination of archival information
- Identify individual researchers/group technical/scientific expertise
- At least one facility to carry out the research and find funding, and identify sufficient space,
- Design and conduct crosses, estimating a minimum of 32 animals needed with 104 produced, use F1 hybrid progeny at Sandy Ridge as part of the study. (Excess may be used in other studies).
- Ownership of animals will be retained by USFWS. Develop proactive position on usefulness of hybrid research.
- Use wolves produced to look at semen characteristics, estrous cycles, viability (juvenile mortality), litter size, sex ratio.

Literature Cited

Carley, C.J. 1975. Activities and findings of the Red Wolf Field Recovery Program for late 1973 to July 1, 1975. U.S. Fish and Wildlife Service Report. Pp. I-v + 1-215.

Red Wolf

(Canis rufus)

Population and Habitat Viability Assessment (PHVA)

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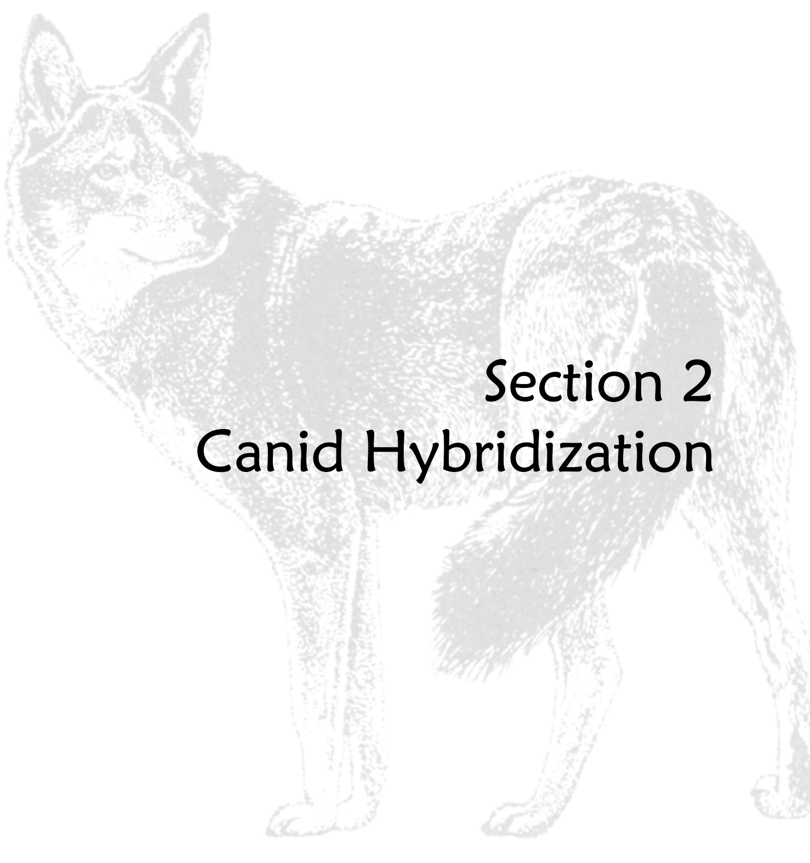


Section 2
Canid Hybridization

Canid Hybridization Working Group Report

Working Group Members:
George Amato, Wildlife Conservation Society
Ed Bangs, U.S. Fish & Wildlife Service
Dave Flemming, U.S. Fish & Wildlife Service
Gary Henry, U.S. Fish & Wildlife Service
Brian Kelly, U.S. Fish & Wildlife Service
Dave Mech, U.S. Geological Survey
Ron Nowak, Falls Church, VA
Mike Phillips, Turner Endangered Species Fund
Mary Theberge, Universityof Waterloo
Robert Wayne, University of California, Los Angeles
Paul Wilson, Trent University
Mary Hagedorn, National Zoological Park (Facilitator)

The Hybridization group met for less than one day. During that time they decided that hybridization was an overarching issue that was essential for further consideration of red wolf recovery. The following set of notes reflect some of the problems outlined by the group and the discussion that was generated by consideration of these processes.

Some discussion took place concerning the likelihood of reaching a resolution concerning the evolutionary origins of red wolves. Bob Wayne argued for avoiding discussion of the question of red wolf origins out of deference for restoring red wolves, because elucidation of origins is intractable.

George Amato argued that perhaps Wayne's approach was not the proper paradigm to follow because the evolutionary history/context of any species is central to recovery of that species.

Mike Phillips argued from the practical aspects of restoration that perhaps we should not follow the paradigm because the resolution of the question of origins might figure prominently in restoration design.

Dave Mech pointed out that given the existence of a conservation management program, it is best to focus on promotion of that red wolf recovery program. Additionally, it is important to recognize that anthropogenic forces facilitate hybridization so that conservation actions must proceed full-steam ahead.

Our initial discussion centered on a variety of issues related to hybridization. These are:

- How much hybridization can occur without threatening phenotypic (behavior, morphology etc.) or genetic integrity of the red wolf?
- Widespread hybridization
- How much hybridization can be tolerated w/o loss of species' phenotypic integrity?
- How is hybridization prevented?
- How do you recognize hybridization in the field and how quickly can decisions be made and implemented. How do we manage hybrids?

- Placing the process in an evolutionary context - what are we managing for, distribution of alleles and allelic patterns that may have occurred 200 years in the past.
- Should we preserve what we have in captivity?
- Complete discussion of what it means when these animals hybridize
- Societal versus more scientific value, societal and political perceptions and responses to the problem: hybridization is not seen as a good thing, legal issues because of the Endangered Species Act (hybrid policy, etc.)
- Administrative response by the USFWS
- Lack of data on the issue in the wild and captivity (fitness of hybrids, mating success and viability, predisposing factors)
- Is hybrid issue of such magnitude that all other issues are superseded by it?
- Are we to assume that this hybridization is a natural process? Is the hybrid red wolf better adapted to local and current conditions? Have we interfered with an important natural process?

Following identification of these issues, the group condensed the list to six major problems for prioritization using paired ranking. These are:

1. How much hybridization can occur without threatening phenotypic (behavior, morphology etc.) or genetic integrity of the red wolf?
2. How do you manage hybridization, i.e., difficulty of recognizing hybrids and to actively manage to prevent their production?
3. How do you place the red wolf in an evolutionary context, should we preserve it in captivity, is the red wolf a species or sub-species, is hybridization a natural process, are hybrids red wolf more adapted to current conditions (i.e., have we interfered with a natural evolutionary process that may not be constructive?).
4. Societal and legal repercussions (Endangered Species Act (ESA) considerations, administrative considerations, considerations and reaction of general public, etc.): the "mutt" response
5. There is a lack of data on hybridization
6. Is hybridization a problem of such magnitude that it supersedes all other programmatic problems (i.e. selection of new reintroduction sites, management of captive population, etc.)?

We discussed the criteria for determining the paired ranking. We did not use paired ranking to set the weighting factors of these criteria, but reverted simply to a consensus based on the discussions. Criteria for ranking problems:

- Biological significance of problem - does problem have the potential to prevent recovery (weighting factor 0.5)
- Feasibility of addressing problem (weighting factor 0.3)
- Scientific benefits from addressing problem (weighting factor 0.2)

The results of the group's ranking procedure are tabulated below, with higher scores indicating overall higher priority placed on that issue for a given criterion by the working group as a whole.

Issue	Criteria		
	Potential for hindering recovery (biological or ecological significance)	Feasibility of addressing problems	Scientific merit of addressing problem
1. How much hybridization can be tolerated	47	31	41
2. How do you manage hybridization	37	38	35
3. What is a red wolf, what is a species, what are we managing for	35	19	32
4. Societal and legal repercussions	18	22	7
5. Lack of data on hybridization	24	24	23
6. If hybridization is a problem of such magnitude that it supersedes all other problems	25	19	23

During the plenary session, Dave Mech noted that Issue # 6 had very uneven scores. Some participants rated this issue quite highly while others assigned it very low priority, yet he felt that everyone in the group felt similarly about the importance of the issue. He raised the question that perhaps there had been a misunderstanding of the group when they voted for this issue. We decided to meet again after the plenary session and we defined our concepts further.

Initially, the group wanted to devise a general statement of the problem and ignore the process of paired ranking because a concern was voiced over results of ranking not representing what the collective group felt was important. Consequently, the group revised the definitions of the six issues and reapplied the prioritization process.

In addition, Issue #6 evolved into a general statement reflecting the collective feelings of the group:

Hybridization that affects the genetic and phenotypic integrity of the red wolf is the primary issue facing its recovery. How we proceed with red wolf recovery is dependent upon how we assess, and if possible, manage hybridization.

Following considerable additional discussion, the group revised the remaining five issues into the following statements:

1. Determine the degree of hybridization that can occur without threatening the phenotypic (behavioral, morphological, etc.) or genetic integrity of the red wolf.
2. Determine how to measure, monitor, and actively manage (e.g. coyote and hybrid control) hybridization levels as determined in the statement above.
3. Determine the evolutionary context of the red wolf and the role that hybridization played in its evolution.
4. Determine ways of contending with the political (i.e. degradation of state and local support), social (mutt effect), legal and administrative (lack of hybrid policy within the FWS) problems.
5. Collect more experimental data on hybridization. For example the program should include breeding interactions, fitness of hybrids, etc.

The criteria upon which these newly-revised issues were to be prioritized were also redefined:

- Potential to affect recovery (weighting factor 0.6)
- Feasibility: logistical, physical, and technical (weighting factor 0.3)
- Broader significance to conservation (weighting factor 0.1)

Based upon these well-defined issues and criteria, the paired ranking procedure was repeated with the results shown below (the weighted totals are in parentheses).

Issue Number	Potential to affect recovery	Feasibility: logistical, physical, and technical	Broader significance to conservation
1	35 (21)	33 (9.9)	31 (3.1)
2	38 (22.8)	36 (10.8)	27 (2.7)
3	15 (9)	9 (2.7)	31 (3.1)
4	14 (8.4)	20 (6)	15 (1.5)
5	18 (10.8)	22 (6.6)	16 (1.6)

Problems 1 and 2 are the highest priorities, however, there was a suggestion to refocus the entire meeting around hybridization questions, and to use the Alligator River population in a manner to test hybridization control. We need to experiment with this situation before we engage in any other activities. We decided to table refocus of the meeting until the morning plenary session.

During the latter portion of the group's time together, a great deal of information was shared and the question was asked, "Can the red wolf be recovered even under the best of conditions?" It appears from recent data that current hybridization levels are already unsustainable in terms of maintaining the current red wolf genotype. If all hybrids were caught and removed, the program could perhaps be maintained. Certainly, some hybrids have been missed, so considerable effort must be directed towards improving this aspect of the program.

It was noted that hybridization is not observed throughout the range of the species – but is not confined just to the edge. Nowak discussed the issue of reticulate patterns as being natural. It may be difficult to save something (i.e., the red wolf) that might not be considered natural. He described the movement of coyotes across the country and argued that we no longer had true red wolves or true coyotes --- they are part coyote/wolves and red wolf/coyotes. Regardless, he thought we should save the current population in a wildlife area as a national monument.

Could this particular perspective be difficult to sell to administrative and political leaders? Flemming thought that it might not, since there were already a host of policies concerning hybridization with the Florida panther, listed fish etc.

Henry suggested that the North Carolina population should be divided into:

1) Dare county population that would be the "pure" recovered red wolf. This could be maintained through extensive trapping, fences etc.
2) Western population that would be an experimental population that would look at hybridization issues. These data could be used for recovering wolves in areas with coyotes in other areas of the country.

One proposal: Fence the Alligator River area. Remove or sterilize coyotes – and add more red wolves to help establish pack structures – etc. Fifty animals is probably the upper limit in that area. Perhaps fire management would help; perhaps, line traps could be used instead of a fence.

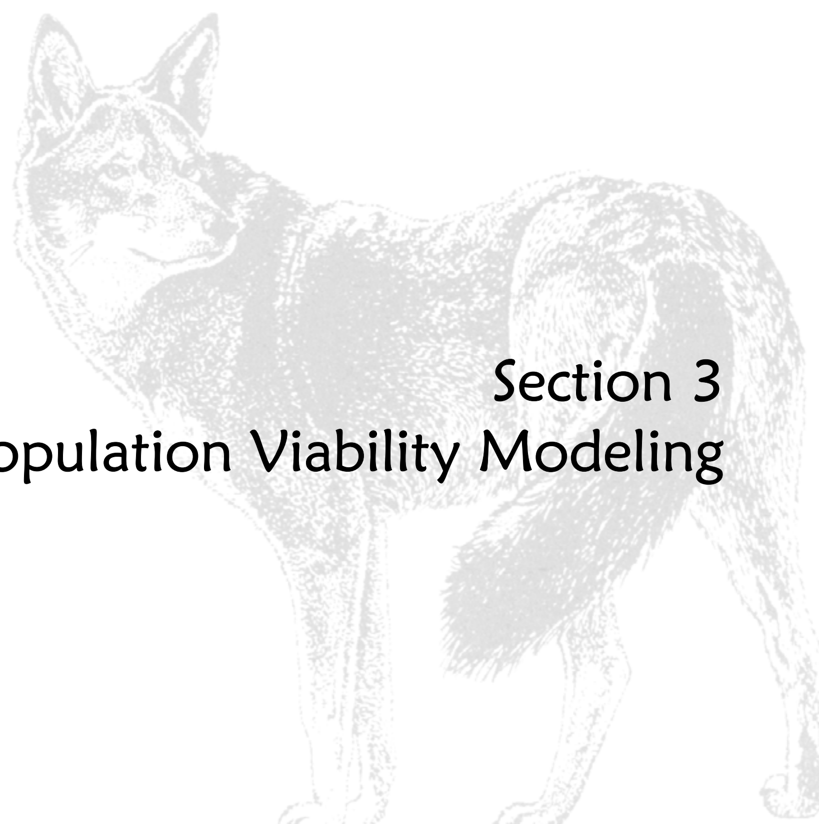
Bob Wayne expressed his sentiment that we should treat the hybridization issue experimentally - test the system. There are concerns about public attitudes for coyote control, expense for a system unlikely to be replicated or even succeed.

Red Wolf

(Canis rufus)

Population and Habitat Viability Assessment (PHVA)

Virginia Beach, Virginia
13 - 16 April, 1999



Section 3
Population Viability Modeling

Population Viability Modeling Working Group Report

Working Group Members:
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Brian Kelly, ARNWR / USFWS
Dennis Murray, Idaho State University
John Theberge, University of Waterloo
Bob Wayne, University of California Los Angeles
Phil Miller, CBSG (Facilitator)

Introduction

The need for and consequences of alternative management strategies can be modeled to suggest which practices may be the most effective in conserving the red wolf in the southeastern United States. Genetic and demographic modeling tools such as *VORTEX* (Miller and Lacy 1999) or other approaches have been used here to study the interaction of a number of life history and population parameters treated stochastically, and to explore which demographic parameters may be the most sensitive to alternative management strategies.

Population viability models are not intended to give absolute answers, since they project stochastically the interactions of the many parameters which enter into the models, and because of the random processes involved in nature. Interpretation of the output depends upon our knowledge of the biology of red wolves, the conditions affecting the populations, and possible changes to these conditions that may occur in the future. For a more detailed discussion of population viability analysis and the use of models, see Miller and Lacy (1999).

General Working Group Issues

As a first step, the group members identified the following issues pertinent to the red wolf population viability modeling process:

- How to model hybridization and its effects on red wolf demographics
- Overall model parameterization – including both means and variances
- Recognize and incorporate the differences between wild-born and captive-born animals with respect to demographic rates
- Use sensitivity analysis to identify research and management priorities
- How to deal with removal separate from mortality
- How to describe the erosion of social structure in red wolf populations impacted by humans – even when the total population numbers are not changing
- How to put metapopulation structures into the modeling process
- Put modeling effort into a broader management context

Using generalized ranking procedures, the group ranked these issues according to priority in the context of generating a more useful population viability model to assist in red wolf recovery. Clearly, the need to better understand the mechanisms underlying hybridization between red wolves and coyotes—and its influence on the future viability of the red wolf in northeastern North Carolina—is a top priority.

Input Parameters for *VORTEX* Demographic Simulations

Mating System: Red wolf breeding system was assumed to be monogamous because biparental care is an important (and well-documented) attribute of the genus Canis.

Age of First Reproduction: It was assumed that the minimum breeding age for females was 2 years; in most canids the onset of estrus in free-ranging females occurs in the second year even though physiologically they may become reproductive sooner.

Males were assumed to become reproductively active physiologically at age 2 even though in this and most canid species actual reproductive activity of most males is probably delayed considerably.

Age of Reproductive Senescence: Maximum breeding age was assumed to be 8, based on information from other canid species (including Algonquin wolves, J. Theberge, pers. comm.). However, studbook information indicates that this may be an overestimate and may need further refinement in subsequent models.

Offspring Production: We assumed that the average proportion of females producing a litter each year was 0.5; this assumption was largely arbitrary and should be adjusted following analysis of existing red wolf data.

Annual variation in female reproduction is modeled in *VORTEX* by entering a standard deviation (SD) for the proportion of adult females that produce a litter in a given year. *VORTEX* then determines this proportion by sampling from binomial distribution with a specified mean (50%) and standard deviation (in this case, 10%).

The maximum litter size was assumed to be 6 individuals based on the average litter size for other canid species. While this may seem to be rather high, we can assign a low probability to such a large litter according to the following distribution:

Litter Size	Frequency (%)
1	0
2	10
3	20
4	40
5	20
6	10

The choice of the above distribution was based largely on intuition but it may be possible to use existing red wolf data to refine these estimates.

Finally, the sex ratio at birth was assumed to be at parity because there exists no information to suggest otherwise.

Male Breeding Pool: It was assumed that, because of wolf territorial behavior, only 50% of males are available for breeding in a given year.

Survival Rates: Red wolf survival rates are similar among sexes but differ among age classes; in addition, survival rates have been shown to be significantly higher among wild- than captive-born animals—presumably resulting from different general conditions between the two environments (Murray et al. unpubl.). We initially utilized survival rates obtained from the current ARNWR population, in which all but one individual is wild-born. Further scenarios can assess the impact of a captive-born component infused into the original largely wild-born population.

Age	Captive-born	Wild-born
0-1	0.37	0.78
1-2	0.45	0.83
Adult	0.60	0.87

We assumed arbitrarily that the SD in annual survival rates for all age/source population cohorts was ± 0.10.

In addition, environmental variation in reproduction was chosen to be correlated to sources of variation in survival because red wolves occupy fixed territories year-round and thus are exposed to similar environmental conditions during the reproductive and non-reproductive seasons. Also, there is no *a priori* reason to anticipate survival and reproduction to be differentially affected by given environmental forces.

Inbreeding depression: Inbreeding depression has not been included in these initial models as, currently, no measurable evidence of inbreeding depression exists in the captive red wolf population (Kalinowski et al., in press).

Catastrophes: Catastrophes are singular environmental events that are outside the bounds of normal environmental variation affecting reproduction and/or survival. For some species, hurricanes, floods, volcanoes, etc. could wipe out a large part of a population in one year. These events are modeled in *VORTEX* by assigning a probability of occurrence and a severity factor ranging from 0.0 (maximum or absolute effect) to 1.0 (no effect).

We assumed that two types of catastrophes, such as a major disease epidemic and a hurricane, are capable of impacting the red wolf population independently. Each type of event was given a frequency of occurrence of 1% annually (i.e., one event every 100 years on average). When each event occurs, both fecundity and survival are reduced by 50% during that particular year and return to their normal values immediately after the event.

Initial Population Size: The current red wolf population was estimated to consist of 80 individuals (B. Kelly pers. comm.). Initial models assumed that these 80 individuals were distributed among age-sex classes according to the stable age distribution calculated from the life table.

Carrying Capacity: The carrying capacity, *K*, for a given habitat patch defines an upper limit for the population size, above which additional mortality is imposed across all age classes in order to return the population to the value set for K. The carrying capacity of wolves in northeast North Carolina was assumed to be 150, based largely on best guess estimates.

Demographic Impact of Coyote Hybridization: We attempted to develop some simple preliminary models that would address the issue of demographic consequences of hybridization between red wolves and coyotes. Our initial hypothesis is that, as the frequency of coyotes increases relative to red wolves, fewer female red wolves will successfully breed in a given year. In other words, the proportion of adult female red wolves that breed annually ("successful breeding" meaning a red wolf female breeding with a red wolf male and not a coyote) will decline. Specifically, preliminary models included a 75% reduction in the proportion of adult females breeding annually over a period of 50 years. We took a conservative approach and assumed that, through some sort of management intervention after 50 years, this rate of decline would stabilize so that, after 50 years, the proportion of adult females successfully breeding annually would have been reduced from 50% to 12.5%.

Results of Preliminary Demographic Models

The tables that follow present the numerical results from the risk assessment models developed during this workshop. The results are described in terms of the following:

r_s	Mean stochastic population growth r_s in the stochastic simulations, calculated prior to any carrying capacity truncation, and averaged across years. The population growth rate in the simulations will be depressed relative to the calculated deterministic projection because of a variety of stochastic processes, such as random fluctuations in breeding, survival, and sex ratio, and possibly inbreeding depression.
$SD(r_s)$	Standard deviation in the stochastic growth rate across simulated populations and across years. Larger SD(stoch r) indicates a less stable population, with more variation in size from year to year. In about 68% of the years, the value of r will fall within 1 SD of the mean.
N_{100} - Ext.	Mean size of the simulated populations extant at year 100.
$SD(N_{100})$	Standard deviation in the population size at year 100 across simulated populations. SD(N) is a measure of the predictability of the final population size. Larger SD(N) relative to N indicates that the final population size of any given simulated (or real) population may deviate considerably from the mean simulation result.
H_{100}	The mean expected heterozygosity (gene diversity) remaining in the simulated population after 100 years, relative to the level of original genetic variation in the population at the beginning of the simulation.

The Baseline Model

We developed a simulation model incorporating our best estimates of red wolf demography and habitat characteristics. We have called this simulation our *baseline model*. Using this set of input data, our simulated red wolf population is projected to increase at a rate approaching 20% per

year (Table 1). This vigorous rate of population growth is due in large part to the low mortality estimates for wild-born individuals compared to their counterparts born in a captive environment and subsequently released into wild habitat. As a result of this rapid rate of growth, there is no immediate risk of extinction under these circumstances, and the simulated population is able to increase in size until carrying capacity is reached in just ten years (Figure 1). However, the extent of original population heterozygosity that is retained is relatively low – below the 90% threshold commonly cited as an important benchmark for maintaining population viability in the short term (i.e., 5 – 10 generations). This is due to the relatively small population size that must be managed within the Alligator River NWR boundaries.

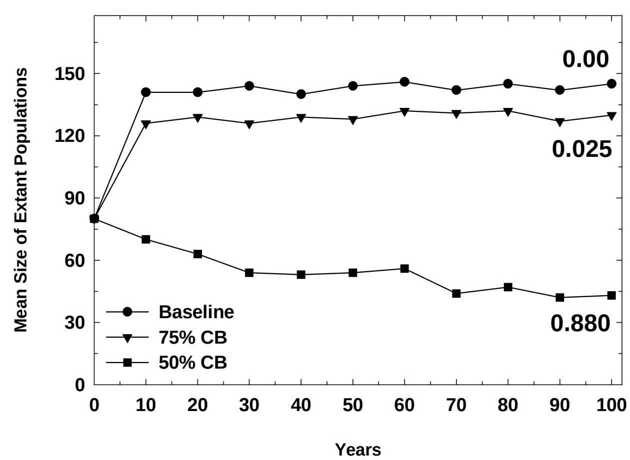
In summary, our baseline model demonstrates some measurable degree of demographic security (in the absence of major catastrophic events that may not be included in our model) but the relatively small population size characteristic of the NENC region may lead to a rate of loss of genetic variation that could lead to longer-term problems with respect to population fitness.

It is important to remember that this baseline model does not include any hybridization events and their associated impacts on native red wolf demographic and genetic structure. An initial attempt to study this phenomenon is provided later in this section.

Table 1. Red wolf population risk analysis: Demographic impact of increasing the proportion of captive-born animals comprising the total simulated population. See text for definitions of column titles.

Conditions	r_s (SD)	P(E)	T(E)	N_{100}–Ext. (SD)	H_{100}
Baseline (98% CB)	0.195 (0.224)	0.000	—	145 (13)	0.809
75% CB	0.101 (0.238)	0.025	—	130 (31)	0.768
50% CB	-0.043 (0.287)	0.880	47	43 (40)	0.576

Figure 1. Population size projections for a simulated red wolf population composed of nearly 100% wild-born individuals (baseline model), and for alternative populations in which the percentage of captive-born (CB) wolves comprising the total population is either 75% or 50%. Numbers accompanying each trajectory indicate the population extinction risk over the 100-year timeframe of the simulation. See text for additional information on model parameterization.



Impact of Releasing Captive-Born Wolves into the NENC Population

Based on the survival analyses of Dennis Murray and his colleagues, the survival rates of captive-born individuals released into the Alligator River population are considerably lower than

those of their wild-born counterparts. In an attempt to simulate the demographic impact of this phenomenon, a pair of models were developed in which the total Refuge population was composed of either 75% or 50% wild-born animals, thereby reflecting a major increase in the percentage of captive-born animals relative to the baseline model previously presented. This increased contribution from the captive population is reflected in an increased mortality rate among all age-sex classes that is directly proportional to the relative contributions of each source to the total population.

As shown in Table 1, the population growth rate is reduced by nearly 50% compared to the baseline model when the simulated population is composed of 25% captive-born animals. However, the stochastic growth rate of 10% remains high enough that the simulated population is able to approach the carrying capacity of 150 wolves and the extinction risk remains low (but, significantly, non-zero). If we assume that the population is composed of 50% captive-born individuals (Table 1, Figure 1), the growth rate becomes significantly negative, the simulated population shows a marked decline in size over time, and the risk of population extinction jumps dramatically to 88% over the 100-year simulation timeframe.

While this small set of simulations is quite simple in its parameterization, the negative impact of higher mortality among captive-born wolves following release is clearly evident. These detrimental consequences may possibly be alleviated by either minimizing the proportion of captive-born animals in the NENC population, or by implementing some set of management actions that would rapidly increase the survival of those animals recently released from a captive environment.

Subsequent demographic modeling efforts – using *VORTEX* or other population viability tools – could perhaps refine this scenario by defining the mortality of captive-born animals as a function of time so that their survival may increase following release and subsequent acclimatization to their new wild surroundings. In addition, a type of modified metapopulation approach – in which the total population is effectively modeled as a pair of "subpopulations" with some degree of interchange among them – could be developed to potentially provide greater realism.

Demographic Impacts of Hybridization with Coyotes

We made an attempt at simulating the demographic impacts of increasing the rate of hybridization among red wolves and coyotes within the Alligator River NWR and surrounding areas. To do this, we had to derive a mechanism by which hybridization could be defined in terms of red wolf demographic rates. Our assumption was that, as the density of coyotes in and around red wolf habitat increases, the frequency of matings between red wolf females and coyote males would likewise increase. This would effectively remove an increasing proportion of red wolf females from the annual total population of breeding red wolves over time – from the perspective of looking at the red wolf population as a demographic entity separate from the sympatric coyote population. Consequently, we simulated this increasing hybridization rate by gradually decreasing the proportion of red wolf adult females that successfully breed in a given year. Again, it is important to remember that "successful breeding" is defined here as a mating between a pair of red wolves, and not between a red wolf female and a coyote male. As such, we are therefore projecting the viability of a "pure" red wolf population that interacts with coyotes within and immediately adjacent to NENC.

In the two hybridization models we developed, the proportion of adult red wolf females that successfully breed each year declines at a linear rate over the first 50 years of the simulation and is ultimately reduced to either 50% or 75% of the baseline value at that time. Beginning in year 51 of the simulation, this value remains constant at the lower breeding rate. Therefore, the final proportion of adult red wolf females that successfully breed is reduced to 25% or 12.5% compared to the original value of 50%.

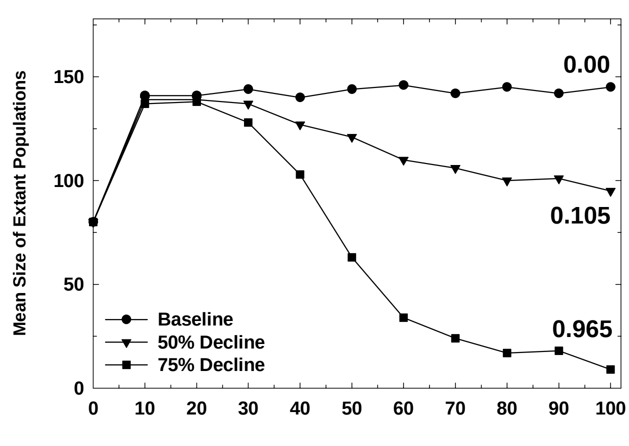
The results of these models are presented in Table 2 and Figure 2. If the proportion of adult females declines by 50% over the first 50 years of the simulation, the population begins to decline after an initial rapid growth phase through the first twenty years of the simulation (Figure 2). This population decline results from the decrease in the proportion of successful female breeders to a level below the original 50% level that is demographically unsustainable. Beyond year 30, the simulated population gradually declines from a maximum population size of about 140 individuals to just under 100 animals at the end of the simulation. Additionally, despite this relatively gradual decline, the simulated population is at a measurable risk of extinction: approximately 10% over the 100-year timeframe of the simulation.

If the rate of hybridization increases to a 75% decline in the proportion of adult females successfully in a given year, the population shows a significantly greater rate of decline following the initial growth phase. Moreover, the risk of extinction is extremely high over a 100-year simulation timeframe as the mean population size drops to about ten animals in 100 years.

Table 2. Red wolf population risk analysis: Demographic impact of increasing the rate of hybridization between red wolves and coyotes. As "hybridization" is defined here as a mating between a red wolf female and a coyote male, this event effectively removes the female from the red wolf breeding pool. This event is therefore simulated in Vortex as a gradual decrease in the annual percentage of successful female red wolf breeders, i.e., those that breed with a male red wolf. See text for additional details.

Conditions	r_s (SD)	P(E)	T(E)	N_{100}–Ext. (SD)	H_{100}
Baseline (50% EE)	0.195 (0.224)	0.000	—	145 (13)	0.809
50% Decline (25% EE)	0.089 (0.265)	0.105	—	95 (49)	0.730
75% Decline (12.5% EE)	0.025 (0.308)	0.965	68	9 (9)	0.486

Figure 2. Population size projections for a simulated red wolf population with no threat of hybridization with coyotes (baseline), and with increasing hybridization threat manifest by a gradual decline in the percentage of successful female red wolf breeders. Numbers accompanying each trajectory indicate the population extinction risk over the 100-year timeframe of the simulation. See text for additional information on model parameterization.



It appears clear that, from the perspective of the simple demographic model presented here, that hybridization between red wolves and coyotes is not sustainable from a simple demographic point of view. As increasingly more coyotes encroach upon red wolf habitat, the increasing frequency of matings between the two species will decrease the reproductive output of "true" red wolves to the point that the rate of red wolf replacement is not of sufficient magnitude to offset natural (and human-mediated) mortality.

This demographic model of a significant hybridization threat is, of course, highly simplified. We are not considering the detrimental impacts of this hybridization event on the genetic structure of the red wolf population. How much hybridization can a population of red wolves tolerate and still be called "red wolves"? Unfortunately, the implementation of *VORTEX* discussed here can not easily help us deal with this question quantitatively. We need to develop a more specific genetic model to investigate the nature and consequences of hybridization between red wolves and coyotes. This is addressed in greater detail in the next portion of this working group report.

If deemed appropriate, additional *VORTEX* models could be developed to investigate the impact of:

- Gradual reduction in available habitat carrying capacity at the annual rate of 0.1%.
- Because of the need to periodically remove wolves causing problems in the wild (i.e., depredations, wide ranging movements, frequenting community, etc.) and that this rate is estimated to be 0.19/year in the NENC population, we might assume the same removal rate for our modeled population. However, it should be noted that this estimate is derived largely from the higher removal rate in captive- than wild-born animals and should be reduced in future modeling efforts where the modeled population consists largely/exclusively of wild-born animals.
- We could assume that the gradual loss of red wolf genetic material in the wild (due to hybridization with coyotes and genetic drift) will necessitate periodic supplementation with captive-born stock. For the sake of simplicity, we might assume that animals would be added on a yearly basis for 20 years and the rate of addition was equal to 0.5 individuals for each age/sex cohort (total of 3 individuals/year).

A Genetic Model of Red Wolf – Coyote Hybridization

A population of red wolves introgressed by coyotes will experience a change in its genetic constitution relative to its original state as coyote genes are introduced into the red wolf population genome. Using standard population genetics theory, one can calculate the proportional loss of red wolf ancestry ("ancestry" is defined here as the proportional change in the original frequency of a given allele present in the initial unhybridized population) as a function of the proportion of hybrid litters produced per generation:

$$G = \frac{q_{RW(t)}}{q_{RW(t=0)}}\left(1 - \frac{m}{4}\right)^{t} ,$$

where

- G = proportion of red wolf ancestry retained in the hybridized population;
- $q_{RW(t)}$ = Frequency of a given red wolf allele at time t;
- m = frequency of hybrid litters produced per generation;
- t = number of red wolf generations (generation length assumed here to be 4 years).

The rate of loss of ancestry is slowed by the fact that hybrids themselves have 50% ancestry to red wolves and are therefore a source of red wolf genes to be backcrossed into the original wolf population. Consequently, this rate is not simply a direct function of m – hence the denominator of "4" in the above expression. In addition, this method assumes that (*i*) 50% of the hybrids will remain in the red wolf population and therefore potentially breed with red wolves, and (*ii*) only one of the two possible hybrid × red wolf crosses – F1 female × RW male – is realized.

We could identify a particular genetic goal for a given level of retention of red wolf ancestry over a specified time frame—for example, 90% retention for 100 years. Using the expression above, we can calculate the maximum frequency of hybrid litters that can be produced while still satisfying a specific genetic goal:

$$m = 4\left(1 - G^{(1/t)}\right) .$$

Figure 3 shows a graphical representation of this relationship. The curves indicate that the proportion of hybrid litters that can be tolerated increases as the target ancestry retention decreases; in other words, a more relaxed genetic goal allows a greater degree of tolerable hybridization. Moreover, a more conservative (longer) genetic management timeframe means that fewer hybrid litters can be tolerated. For example, if the genetic management goal is **90%** retention of red wolf ancestry over **100** years, the maximum tolerable frequency of hybrid litter production is **1.7%** (i.e., 1 out of every 59 litters). However, if this goal is relaxed to 80% over the same time period, the frequency increases to 3.55% (i.e., 1 out of 28 litters). Additionally, if **200** years is the management time horizon, the original frequency is reduced to **0.85%** (i.e., 1 out of every 118 litters).

Current estimates of hybrid litter production are on the order of 15 – 20% over the last 3-4 years, roughly equivalent to one red wolf generation. The genetic model presented here suggests that this rate is far too high to achieve any reasonable genetic goal. Indeed, an ancestry retention of 50% characterizes a population composed entirely of red wolf – coyote hybrids.

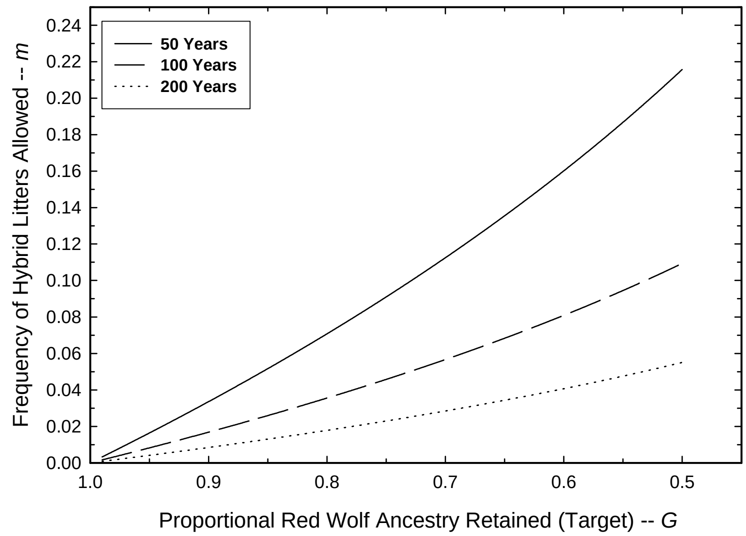


Figure 3. Maximum tolerable levels of red wolf – coyote hybridization as a function of genetic management goal (defined as the target level of proportional red wolf ancestry retained in the managed population) and program time horizon. Rate of hybridization is expressed here in terms of the proportion of total litters produced annually that result from a hybrid mating.

We addressed a number of scenarios (with varying degrees of realism and acceptability) under which red wolf genetic ancestry could be retained. It was felt that 50% red wolf ancestry was unacceptable because it is characteristic of wolf-coyote hybrids. One question that was posed was whether/not hybrids are capable of producing offspring in the wild; the general consensus was that hybrids likely were fertile, although data allegedly are not available to confirm this suspicion with this taxon in this area.

It was also suggested that newer models developed to evaluate the impacts of hybridization be spatially-explicit and evaluate the rate of hybridization given several scenarios (i.e, hybridization restricted to the periphery of the core population, hybridization along the periphery with limited core penetration, random spatial distribution and equal mating probability for each animal). In addition, an evaluation of hybridization probability to density of species (i.e., whether hybridization probability is uncorrelated, positively correlated, or negatively correlated). In all likelihood there will be a negative correlation between coyote and red wolf density, whereby high wolf densities will beget low coyote densities.

In addition, it was noted that the topic of mate selection and offspring viability of wolves, coyotes, and hybrids should be assessed in captive and wild animals because the outcome of such studies will importantly affect the parameterization of the model.

Literature Cited

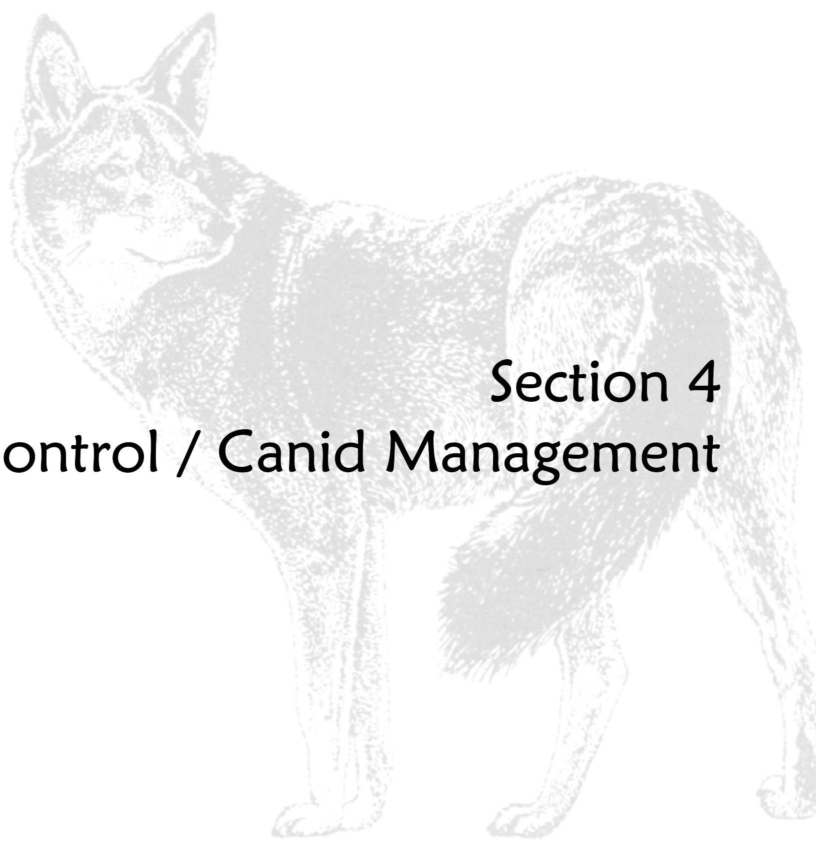
Miller, P.S., and R.C. Lacy. 1999. Vortex: A Stochastic Simulation of the Extinction Process. Version 8 User's Manual. Apple Valley, MN: Conservation Breeding Specialist Group (SSC/IUCN).

Red Wolf

(Canis rufus)

Population and Habitat Viability Assessment (PHVA)

Virginia Beach, Virginia
13 - 16 April, 1999



Section 4
Biological Control / Canid Management

Biological Control/Canid Management Working Group Report

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After recognition by all participants in the plenary session that the problem of hybridization was of over riding concern, the working groups were reformed to address specific hybridization-related issues. The primary question facing the newly formed Biological Control/Canid Management Working Group was: how do we manage hybridization to benefit red wolves? The group identified 6 issues related to this question and then developed recommendations and actions to address them. In addition, this working group put forward a set of specific, innovative management actions and related recommendations for consideration.

Issues

1. Need to identify hybrid genotype

   There is an urgent need to know what we've got in the population and to do this a reliable, rapid method to detect hybrids must be developed.

   Recommendation:
   Fund research into markers for identification of hybrids and rapid turnaround of samples and, if possible develop a field test.

   Actions:
   1. Consider multiple approaches simultaneously.
      - Gene marker insertion with field readable expression – NASA Bioscience Center-Tulane
      - Forensic Elisa – North Carolina State Bureau of Investigation (NCSBI)
      - Other

2. Bid process to find lab to analyze samples from wild canids to identify hybrids.
   - Ashland Forensics Lab
   - Bob Wayne?
   - 1000 genetic labs in US

3. Captive program should supply captive stock blood and scat to DNA lab for baseline data set.

2. Can we switch the balance of population survival between red wolves and coyotes?

The maximum survival of the red wolf may not be related simply to an increase in their density relative to coyotes. However, assuming hybridization is a function of species density, altering the following parameters to favor red wolves may be beneficial:

- prey available to red wolves, not coyotes
- habitat favorable to red wolves, not coyotes
- trapping / removing coyotes
- sterilizing of coyotes
- augmentation of red wolf pups
- chemical repellants

Recommendation:

Implement biological control until we can better understand hybridization management and/or the balance is shifted from coyotes to red wolves.

3. Where to focus effort?

Several options were discussed in detail.

- Focus all effort on the current Alligator River National Wildlife Refuge (ARNWR) site only
- Manage current site (using gradient approach described below) while continuing to work on criteria for site selection.
- Focus on finding an alternative site
- Postpone, but not abandon, looking for alternative site

Recommendation:

Issues are important and complex and there is still so much uncertainty that effort should be focused on ARNWR.

Once this decision was made, the discussion turned to whether or not to manage the ARNWR consistently throughout the site or to separate portions for application of different management actions (see gradient implementation concept below). There was spirited discussion about the various means for isolating portions of the site and where management effort would be applied. Some of the concerns that surfaced regarding the splitting of the current site included:

- Other species
- Feasibility of the plan
- Adequate size of minimum number of groups that make up a population
- Expendability of red wolves at ARNWR

- The need to learn by our actions
- Political/social risks
- Risk of closure of red wolf program

4. Need to optimize recovery on the site by whatever means available.

Recognizing that hybridization is the primary problem, all available techniques must be used to minimize it throughout the site.

Recommendation:
All management actions and studies must first and foremost prevent coyote genome from entering red wolf population.

Actions:
Optimize recovery on site by the use of multiple techniques and shift the basic unit of management from the entire site to specifically defined territories.

Possible techniques:

- Fence off peninsula
- Sterilize coyotes on peninsula
- Lethal control of anything not marked
- Leave population alone to see if it can survive
- Insert marker gene
- Manage NENC intensively to minimize hybridization

5. Methods to evaluate success of studies/management actions

Recommendation:
All studies/management actions must include methods for evaluation of their success and effectiveness.

Actions:

- Stabilization / expansion of coyote / hybrid free zone as described by current trapping results
- Western movement of hybrid front
- Decrease in portion of hybrid litters (model may give us this info) relative to wolf litters
- Decrease number of hybrids based on fecal analysis identification, trapping results, etc
- Answers to study questions provide information

6. Is biological control possible in the long term?

Recommendation:
Implement biological control until we can better understand hybridization management and/or the balance is shifted from coyotes to red wolves.

Note: Must define what is meant by long term in a management context and determine level of effort necessary for long term biological control.

Management Actions

Throughout the course of developing these six issues, three themes emerged which required considerable debate. The discussion surrounding these themes of study vs. control, the gradient implementation concept and sterilization vs. euthanasia resulted in the development of an adaptive management strategy for the Alligator River site.

Study vs. control

We are in a crisis situation so we have to ask ourselves whether we have time to study the effects of hybridization and biological controls or if we should simply apply the strictest control available across the board. Although we are in a crisis, it is dynamic with changes requiring constant decision-making. The working group agreed, after intense discussion, that the best response is to control AND study simultaneously to avoid continued decision-making without needed knowledge. The primary objective in this combined approach should maintain preventing the coyote genome from entering the red wolf genome as a primary tenet.

Valuable knowledge can be gained from asking the right questions while implementing management actions.

For example:

- Do sterilized coyotes take up red wolf breeding spaces?
- Will neutered hybrids hold territories against intact coyotes?
- Do territories overlap?
- Does hybridization occur evenly across territory?
- Can coyotes and red wolves be kept apart?
- Is there a management technique that will limit the hybridization of coyotes and red wolves?

Gradient implementation concept

The gradient implementation concept refers to the desire to answer questions using different techniques in different areas. This was a crucial concept in the development of the management strategy. It was decided that adoption of the gradient concept would increase the opportunity to learn from the results of various management actions, increase the probability of success and ensure appropriate allocation of resources.

Note: Wolf crew will decide, on the ground, where to apply which studies/management actions, focusing on the area with the most probability to be coyote-free zone. The experimental design of any study will include criteria to determine where to implement, for how long, when to stop.

Sterilization vs. Euthanasia (removal)

Sterilization:

- Avoids creation of vacuum
- Allows choice of time to remove from population
- Allows study of interaction –can efficiently remove collared animals later
- Helps define area where you have info
- Extends time before crew has to go back in
- Occupies space longer

Euthanasia:

- Avoids the issue of competition for breeding spaces
- Reduces competition for food
- Cheaper
- Faster
- Only method for litters / newborn

We propose to implement biological control and study control methods simultaneously. We will use multiple control methods to determine the best long-term method of control for recovery of the species. The primary objective in all cases is the prevention of coyote gene flow from entering the red wolf genome. Management actions will be chosen with this as primary directive.

Hypotheses to test:

1. Red wolf and coyote home ranges are of equal size.
2. Red wolf and coyote territories overlap.
3. Red wolves do not directly cause coyote mortality.
4. Hybridization will occur uniformly across wolf populations.
5. Hormonally intact sterilized coyotes will hold territory from invading intact coyotes.
6. Hormonally intact sterilized hybrids will hold territory from invading intact coyotes.
7. Inserted wolves can reclaim territories from extracted hybrid/wolf or coyote/wolf pairs.

Recommendation:
Establish a technique for reliable on-site field determination of hybrid status and establish a relationship with a genetics lab(s) for rapid results.

Experimental designs will use territories as the sample units. Decisions on hybridization design will be situational using inclusion/exclusion criteria. For example, use of sterilized hybrids will be in situations where replacement wolves are not in the territory or available from captive stock. We consider the identified hypotheses to be inter dependent and equally critical to successful management of the coyote hybridization problem. We envision them being tested in one integrated study using territories as the experimental unit with different territories being assigned to cohorts based on inclusion and exclusion criteria. This should occur to achieve population size N determined by a suitable power study of the design and all experimental data collection can be implemented through a cogent management plan.

Gradient Implementation Management Strategy

1. Coyote-Free Territories (CFT)

- Confirm red wolf territories
- Determine number of coyotes present – baseline
- Identify any gaps in territories – what's in there
- Euthanize ALL coyotes / hybrids
- Monitoring (pre-breeding season) to be sure area maintains as coyote-free (telemetry and fecal analysis and trapping)
- Collect blood from all individuals and have analyzed as soon as possible

- After CFT established, if monitoring and find coyote, sterilize, collar and release

2. Isolation Zone

- Remove all coyote / hybrid litters
- Sterilize coyote / hybrid adults; collar and release
- Collect blood from all individuals and have analyzed as soon as possible
- Insert appropriate red wolves at appropriate time (when captive program can supply, relative to age and sex, relative to season)
- Focus on 2 beachheads (at risk sites)
- Remove individual coyotes paired with red wolves and replace with red wolves from islands/ captive program (use release techniques and individuals to increase probability that red wolves will stay in area).
- Insert a red wolf when a known red wolf loses mate OR when a single red wolf can be identified
- Leave sterilized coyotes in areas where unable to establish red wolves
- Continually review results and revise management plan accordingly

3. Dispersal Zone (DZ)

- Manage public opinion
- Agree on how to message this new management plan to all stakeholders
- Collect blood from all individuals and have analyzed as soon as possible
- Respond / capture problem wolves
- Respond to coyotes / hybrids opportunistically.
  Euthanasia as determined by crew and landowner
  Sterilize and collar
  Leave them alone
- Investigate increased access to private land and tools for encouraging habitat management and conservation on private lands. Additionally, investigate current resource conservation initiatives to determine how red wolf recovery initiatives should be incorporated. Use current and additional data to determine habitat use and land management practices that: maximize red wolf population growth and favor red wolf range over coyote.
- Use this zone to collect any additional data to answer study hypotheses.

Notes:

- The management goal of this gradient implementation strategy is to progressively expand the boundaries of the Coyote-Free Zone as expertise and confidence in establishing this zone is developed.

- It was suggested that we consider the competitive control points concept and employ a strategy in the dispersal zone of introducing large numbers of sterile coyotes to preemptively "fill" territories until we move the isolation zone out to these areas.

Resource needs:
With the exception of the recommendation to find a field identification test, all recommendations can be implemented with the existing financial and personnel resources.

Measurable outcomes:

- Stabilization or expansion of coyote / hybrid-free zone based on number of territories.
- Decrease in proportion of hybrid litters to wolf litters in NENC
- Successfully test stated hypotheses
- A reduction on the number of hybrids in the area based on trapping data exploring newer technologies such as seat analysis

Timeline:

- 1 year to create Coyote Free Territory (CFT).
- Annual evaluations of measurement of success for minimum of 6 years.

Summary of Recommendations

1. Revise recovery plan according to recommendations from this workshop
2. Postpone selection of new reintroduction site and focus effort on Alligator River National Refuge site.
3. Consider set of criteria derived from Site Selection Working Group when selecting this new site
4. Focus necessary resources on development of a rapid technique for canid identification and develop relationships with a lab(s) willing to do this work
5. Implement biological control until we can better understand hybridization management and/or the balance is shifted from coyotes to red wolves.
6. Implement the management actions listed above to prevent coyote gene flow from entering the red wolf genome.
7. While implementing management actions, collect data needed to test the hypotheses (answer the questions) listed above and ensure that all management actions include methods for evaluation of their success and effectiveness.

.

Appendix I

Criteria for insertion animals

Recommendations:

1. Island facilities breed pair this season so offspring will be ready for insertion
2. If one needed prior to availability of animals, translocate animal from DZ to CFT
3. In all cases, individual(s) chosen must be optimum candidate for relocation (age, sex, group size, original territory, etc)

Appendix II

While the Biological Control Working group was developing the management strategy outlined above, the Monitoring Working Group was designing a similar strategy. When the two groups reviewed the specifics of the strategies, one major difference was found. The monitoring group was advocating removal of coyotes while the Biological Control group suggested sterilization. A plenary discussion of two plans resulted in the following set of comparisons:

	Sterilization	Removal
Stop Gene Flow	from territory	from animal
Duration of Effect	2-4 years	< 6 months
Identify area involved	yes	no
Capture effectiveness of effort/animals	2X capture	X
Removal time identifiable	yes	partial
Short-term efficiency	no	yes
Permit wolf colonization from existing RW pop	no	yes
Contribute to "studies"	yes	no

In addition, the following general workshop statement was drafted by members of each of the two groups:

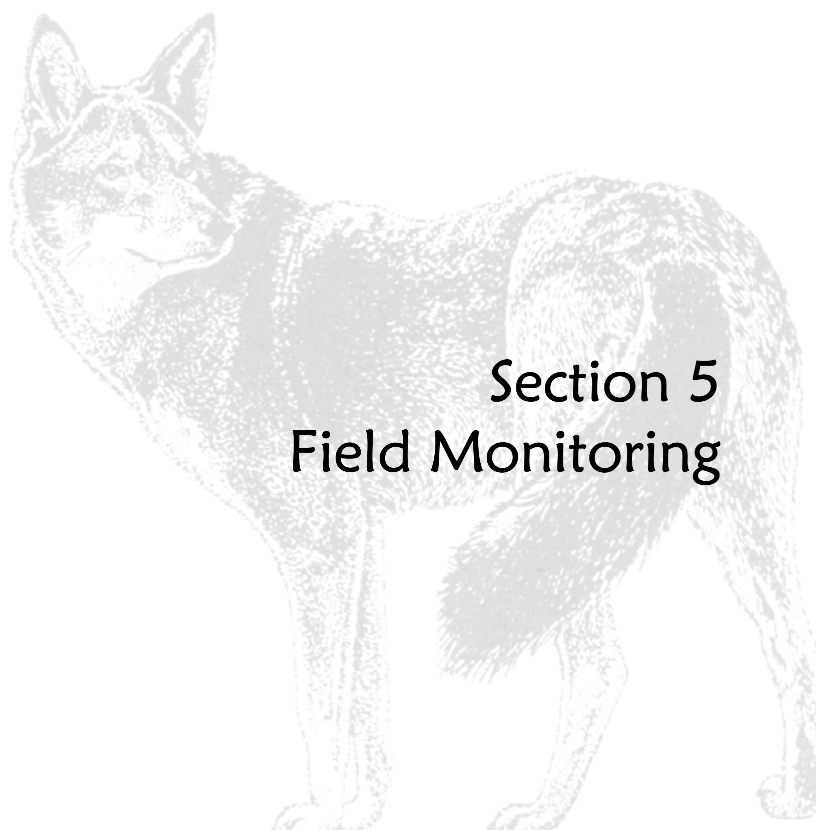
> The Red Wolf Recovery Program has had significant successes over its history, including but not limited to perpetuation of the red wolf genome in captivity, third generation wild pups, and a population distributed over one million acres. It is vital to perpetuate this success. However, hybridization in the free-ranging population has been recognized as a serious threat to the continued success of this landmark program. Because of this threat, our primary recovery focus must be protecting and promoting the growth of a self-sustaining, non-hybridizing population of red wolves in the wild and sustaining an active captive component. Actions to be taken will use an adaptive management approach that will not compromise the ability to achieve this goal.

Red Wolf

(Canis rufus)

Population and Habitat Viability Assessment (PHVA)

Virginia Beach, Virginia
13 - 16 April, 1999



Section 5
Field Monitoring

Field Monitoring Working Group Report

Working Group Members:
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Paul Wilson, Trent University
Jack Grisham, Oklahoma City Zoo (Facilitator)

Introduction

The charge of the field monitoring group was to recommend methods and direction for monitoring free-ranging red wolves. After an initial brainstorming session designed to elicit a set of issues of relevance to this group, fifteen items were listed and prioritized using a paired-ranking system according to the following three criteria.

Priority rankings - criteria for evaluating topics	Score
1. Is it directly related to meeting recovery goals	18
2. Logistic and economic feasibility	1
3. Data needs/gaps/urgency	8

Issue	Score
Estimate population w/ eye towards recovery goals -- assumes that you can identify individuals as to species	91
Interspecific interactions among carnivores and with prey/livestock	89
Experimental design/hypothesis testing	87
Prey abundance	80
Effectiveness/accuracy/precision of monitoring schemes	77
Sociopolitical monitoring	75
Research prioritization / model parameterization	68
Documentation of individuals animals -- documentation of what is there, all canids (Canis)	65
Monitor viability of population (monitoring - individuals, population)	62
Expanded collaboration	57
Survival rate of pups	46
Centralized data bank (standardized methods)	39
Training sociopolitical issues	32
How do you get the most bang for your buck	31
Increase use of Geographic Information System (GIS) technology	31

After the first workshop plenary session and the questions posed by the whole group during that session, the initial list was revisited on day two. The original list of fifteen issues was refined down to seven priorities using just one new criterion. After prioritizing, again using paired ranking, the following priorities surfaced:

Criterion: Related to recovery of the red wolf

Issue	Score
Hybridization incidence and effect over time	42
Population dynamics/demographics	40
Document individual animals; monitor population viability (disease, survival, etc.)	
Population monitoring - "how many?"	36
Prey relationships	20
Sociopolitical attitude/training	12
Livestock relationships	10
Interactions w/ other carnivores	8

The Field Monitoring Group dynamics changed on day two throughout the meeting with the consolidation of Hybridization Group and flow of original members to other groups. Currently 50 red wolves and two coyotes are being monitored in NENC. Now is the best time for initiating the projects in ARNWR with the recent relocation of red wolf personnel and resources from the Smokies. The group recognized the hybridization problem and the need to do something about it. It is important to note that the group felt strongly some type of ad hoc/advisory/recovery team, consisting of 6 - 10 individuals, be maintained to periodically review and assist the red wolf personnel. The ad hoc/advisory/recovery team needs to meet on a regular schedule to review the progress of this work (six months, a year, etc.). Also, specialized groups/teams need to be developed to address specific problems: hybrid index, skull radiographs, genetic testing and morphology. Suggestion of correlating measurements and weights from free-ranging red wolves will be analyzed to develop parameters for evaluation of red wolves, red wolf/canid hybrids in the field. There is also a need to have the captive population used as a reservoir for the free-ranging population for re-introductions and sampling is paramount.

From these discussions and feedback in the Plenary sessions, the following Action steps were developed.

Action Plans:

The use of good science is important in the development of all projects. These should include, but not be limited to the following items: experimental design/quality control; effectiveness/accuracy/precision on monitoring schemes; the use of GIS; a centralized data bank and collaboration with other agencies, universities and researchers.

1. Hybridization - incidence/effect over time

- Number of breeding pairs that are wolf/wolf, wolf/coyote, wolf/dog.
- We need guidelines in determination of a red wolf.
- Distribution and abundance of coyotes and free-ranging dogs in relation to red wolves prior to, during, and after reintroduction.

2. Population dynamics/demographics

- Reproduction, survival, dispersal, age at first reproduction, movements, distribution, density, sex ratio and age structure, morbidity, mortality, growth rate.
- Continue current handling of pups to monitor and assess; add transponders, consider taking blood samples for analysis.

3. Population monitoring - how many?

- Modify techniques as the population grows and expands and you can't track every individual.
- How do we address population enumeration (i.e., estimate rather than count (confidence intervals))?
- Further use of GIS system to facilititate numeration, population data, analysis.
- Collection of scats for analysis

4. Prey relationship

- Distribution, abundance, and composition of prey species (e.g., raccoons, deer)
- Gain enough knowledge that wolf has enough to eat and to address public issues.
- Collection of scats for analysis

5. Sociopolitical attitude/training

- Documenting the sociopolitical attitudes of stakeholders.
- Provide training (e.g., negotiation techniques, conflict resolutions, involving stakeholders, team building, etc.) to red wolf personnel.
- Broad brush education to all stakeholders.
- Create a periodic monitoring system to check our effectiveness.

6. Livestock relationship

- Monitor how often livestock depredation occurs.
- Ensure rapid response when depredations occur (communication between FWS and stakeholders).

7. Interactions with other carnivores

- Everything but coyotes. Bobcats, foxes, bears, free-ranging dogs.
- Temporal and spatial use of landscape. Dietary overlap. Interference competition.
- Scat collection for analysis

Recommendations:

Revise recovery plan (recovery criteria)

Priority Action Plan

Rationale Statement

Our group considered the relative merits of various manipulations and experimental approaches. We feel that the problem of coyote gene introgression into red wolves is so great that it is unwise to utilize any of the NENC recovery area for hypothesis testing. Such hypothesis testing removes some packs from being managed for the primary goal of protecting and promoting the growth of the self-sustaining, non-hybridizing population of red wolves in NENC. Resolution of

the data needed to address various null hypotheses is difficult to obtain because of limitations of field work. Conclusions from hypothesis testing will be difficult to draw from small samples, especially considering variability in canid behavior.

Issue 1: Hybridization - incidence/effect over time
Problem: Red wolves interbreed with non-wolf canids
Goal: Protect and promote the growth of a self-sustaining, non-hybridizing population of red wolves in NENC

Actions:

1. Maximize number of releases to suitable sites to maximize red wolf population growth
   - A. Pre-release surveys
   - B. Landowner and other logistics
   - C. Hard and soft releases
   - D. Possible release sites in order of priority:
     1. Mainland Dare County (Durant Island, ARNWR, and other sites)
     2. South of Lake Mattamuskeet
     3. Northern Tyrrell County (north of US 64)
     4. Pocosin Lakes National Wildlife Refuge
     5. Farther west as opportunities present
   - E. Recommend to captive group that they begin maximizing the number of release candidates (up to 6 pairs for 1999-2000).
     1. Put pairs together as soon as possible and move to Sandy Ridge or islands.
     2. Goal to release between November 1999 and mid-March 2000.
     3. Provide other wolves as needed to pair with wild, solitary wolves.
     4. Ideal wolves for release are 2-4 years of age with reproductive experience.
     5. Maximize the involvement of island-reared wolves in the release campaign.
     6. Point of introductions is to promote growth of population, not genetic stabilization
     7. Disposition of recently released animals will be decided on a case by case basis
   - F. Sandy Ridge (ARNWR captive facility) should be maintained for pre-release candidates

TIME LINE: 1999-2000 and beyond as needed
OUTCOME: See final outcome summary

2. Lethal control of coyotes and non-wolf canids.
   - A. Kill coyotes and non-wolf canids in Dare, Hyde, Tyrrell, Washington, and Beaufort Counties (in that order of priority) with reviewed SOPs.
     1. "Banking" of biological samples including blood, skulls, (periodic analysis of skulls by trained/knowledgeable personnel) etc. Occasional collection of entire skeleton and skins. Consider banking semen if collection can occur during breeding season.
     2. Necropsies should be standard (including collection of reproductive tracts.)
   - B. Ability to differentiate hybrids (NEEDS TO BE APPLIED QUICKLY):
     1. Morphology from captures/releases in NENC and info from Algonquin
     2. Hybrid index
     3. Skull radiographs
     4. Genetics test conducted at ARNWR
     5. Possible outcomes

a. Radio-collar and release any animal that passes test(s)
b. Any animal that fails morphological test:
1. Any coyote captured is euthanized
2. Questionable animals should be maintained in captivity to await results of genetic tests

TIME LINE: 1999-2004
OUTCOME: See final outcome summary

3. Assessment study (Is lethal control necessary?/get out of coyote killing mode)
A. Assessment during control period
1. Processing and collaring/recollaring any red wolves captured and then released
a. Monitor for vital life statistics, for example:
1. Distribution (territory characteristics with spatial and temporal distributions/GIS application) and density
2. Reproduction
3. Mortality
2. Ongoing assessment to estimate abundance of coyotes
a. Rate of capture (non-wolf hybrids/trap night)
b. Collection of scats (identify as wolf or non-wolf)
c. Howling surveys
d. Reports of crew and non-crew members of coyote sightings
e. Documentation of wolf population
B. Assessment of program after lethal control finishes
1. Lethal control for 6 years (two generations of three years per generation).
2. Assessment program continues for three years after termination of lethal control
a. Field work continues except for lethal control aspect
b. Coyotes still entering area?
c. Ability to "short-circuit" if necessary

TIME LINE: 1999-2007
OUTCOME: See final outcome summary

4. Advisory Committees
A. Diagnostics/identification
1. Goal for internal ability to genetically identify canids (blood and scat)
B. Advisory Team
1. Consists of 8 to 10 participants from this meeting
2. First meeting in 6 to 12 months
3. Action-oriented team

TIME LINE: 1999-2007
OUTCOME: See final outcome summary

5. Other related activities/collaboration
A. Assess potential development of hybridization in North Carolina by evaluating past and present status in southeast Texas
B. Analysis of morphological data from NENC captures

TIME LINE: 1999-2007

OUTCOME: See final outcome summary

Although items 2 - 7 (see pages 48-49) were not developed into Action Plans, they are still important and relevant to all studies/projects currently underway or to be developed in the future.

Final Outcome Statement:

Final determination if the goals were met or not met and attendant determination by USFWS on the fate of red wolf recovery program (development of a new site, preservation of mainland Dare County and captive population, development of fencing around ARNWR or termination of program)

Summary

On day four of the meeting a small group of two individuals from the Monitoring Working Group, two from Wild Canid Working Group and one from the Captive Working Group met to find common ground and reach an agreement to move forward on the red wolf program. The goal was to develop a statement that would achieve a doable action plan that can work towards the goal of a self-sustaining free-ranging red wolf population. This general workshop statement is shown below.

> The Red Wolf Recovery Program has had significant successes over its history, including but not limited to perpetuation of the red wolf genome in captivity, third generation wild pups, and a population distributed over one million acres. It is vital to perpetuate this success. However, hybridization in the free-ranging population has been recognized as a serious threat to the continued success of this landmark program. Because of this threat, our primary recovery focus must be protecting and promoting the growth of a self-sustaining, non-hybridizing population of red wolves in the wild and sustaining an active captive component. Actions to be taken will use an adaptive management approach that will not compromise the ability to achieve this goal.

Red Wolf

(Canis rufus)

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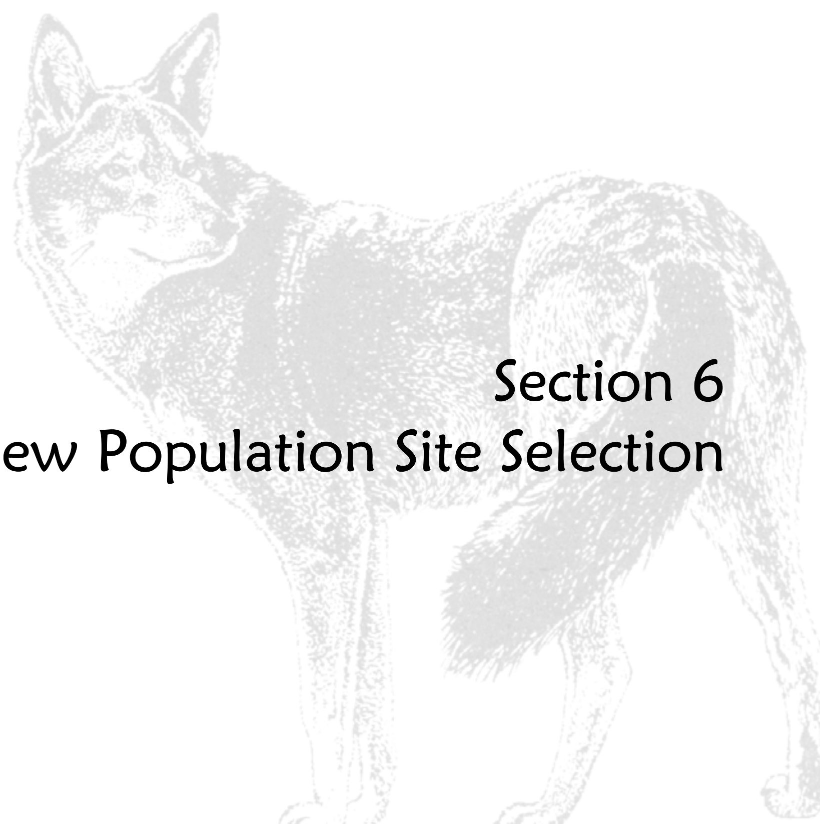

Section 6
New Population Site Selection

New Population Site Selection Working Group Report

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Kathy Whidbee, U.S. Fish & Wildlife Service
Aubrey White, Red Wolf Coalition
Onnie Byers, CBSG (Facilitator)

Goals

1. Develop list of criteria for choosing site
2. Provide rationale for each criteria
3. Prioritize list of criteria
4. Outline site selection process describing how Service is to use criteria for decision making. Include aspects of outreach/education and legal protection.

The working group first addressed the question of whether or not this is the right time to select a new site. It was determined that development of criteria and rationale for those criteria would be beneficial even if it is the decision to choose a new site is postponed.

Criteria for Site Selection

Biological
Socio-economic
Socio-political
Logistical

Biological Criteria for Population Survival

- #1. Reproductive isolation from coyotes
- Adequate prey base
- Minimum space requirement for 3 or more family groups (intensive genetic management required)
- Human settlement (density & distribution)
- Shape of site, circular, reduce edge, or peninsula
- Minimal competition w/ other large predators (ex. Florida panther)
- Low road density relative to type
- Low prevalence of infectious & non-infectious (i.e.: low habitat health risk) disease (low canid density diminishes concern)
- Minimal conflict w/ other managed species (ex. sea turtles
- Minimal conflict with livestock

Socio-Political Criteria for Population Survival

- Distance from human population centers
- Landownership/landuse amenable to long-term recovery particularly private vs. public land
- Tolerant landowners
- Supportive agencies/institutions (State Fish & Game, Farm Bureau)
- Tolerant / vocal support
- Lack of conflict w/ other human activities, e.g. hunting (some types of hunters might welcome red wolf populations)
- Road density/type (potential for conflicts often indicated by road density; increase in road density increases access for hunters as well as other human access)
- Shape of site (minimize edge)
- Minimal conflict with livestock (compensation program)

Socio-Economic Criteria for Population Survival

- Tourism dollars going to local community leading to public support
- Low risk to other economic interests
- Cost of program implementation (including outreach programs)

Logistical criteria

- Physical access to recovery site
- Radio signal problems – topography
- Climate (for flying, etc)
- Elevation

Highest priority must be given to biological requirements. Socio-political, socio-economic and some logistical criteria can be influenced or compensated for (i.e., spend more money to overcome unfavorable logistics) but, if the site doesn't meet biological criteria, public support and perfect logistics won't improve it as a site for red wolves.

Notes: Before implementation of a new reintroduction site, information on conditions that will assure red wolf genetic stability must be obtained.

Outline of site selection process

1. Site selection should proceed in a step-wise fashion, first winnowing down, based on best available data, the current list of potential site to a list of the best 6 sites for further investigation. Then select the top 2 sites for release and conduct a prospective habitat health risk assessment.

2. Include best and worst case scenarios regarding hybridization when making decisions regarding site selection.

3. Include historic knowledge in site selection decision-making process. By reviewing the choice of the Smokies site, we can learn whether the problems were biological, socio-political, economic or logistical.

- Didn't have detailed list of criteria for picking site at time Smokies site was chosen
- It was a political decision
- All Federal land
- Wolves went on private land – socio-political problem
- Possibly inadequate prey available
- Extremely low pup survival – disease, disturbance/stress
- The door was open
- High elevation – related to poor access; inability to monitor

4. Coyote issues must be of primary concern when choosing future sites.

   A. High food availability leads to high coyote density
      a). Consider island populations. Small island area requires constant intervention (genetically)
      b). Consider pre-release removal of coyotes; need "critical mass" of core population
      c). Sterilize coyotes

   B. Need to know coyote demographics and population surrounding chosen site

   C. Conditions potentially limiting hybridization: ratios of number of wolves to coyotes, density of coyotes in area surrounding site, and need "critical mass" of red wolves out there

   D. Need to know if the peninsula NENC is saturated with red wolves.

Note: Some observational data suggest that red wolves may be able to maintain dominance over coyotes in habitat similar to that from which last red wolves came: dense, evergreen understory, swamp. These preliminary observations must be pursued with additional information.

5. Site Size Issues
The minimum area requirement of 170,000 acres (680km^2) in the current Recovery Plan excludes islands. There is a need to discern how this figure was chosen and to consider revision of this number during a reassessment of the Recovery Plan.

Based on the above discussions the following recommendations were made:

1. Current resources should be focused on acquiring information on conditions that will assure red wolf genetic stability.

2. Determine if wolves can maintain themselves in presence of coyotes.
   Ensure red wolf genetic stability until we better understand the factors affecting coyote hybridization rates. Until this can be ensured, any release site must be an "island" population. An "island" can be an actual island, a fenced site or a site isolated by some other secure geographic barrier. If data show that genetic stability can be ensured in the presence of coyotes, other non-"island" sites can be considered

3. Revise Recovery Plan based on current knowledge about the apparent threat of hybridization. Specifically consider the following: 1) the 170,000-acre minimum area requirement is

unrealistic; 2) intensive management of various sorts will be required; 3) red wolves may need to be put outside historic range.

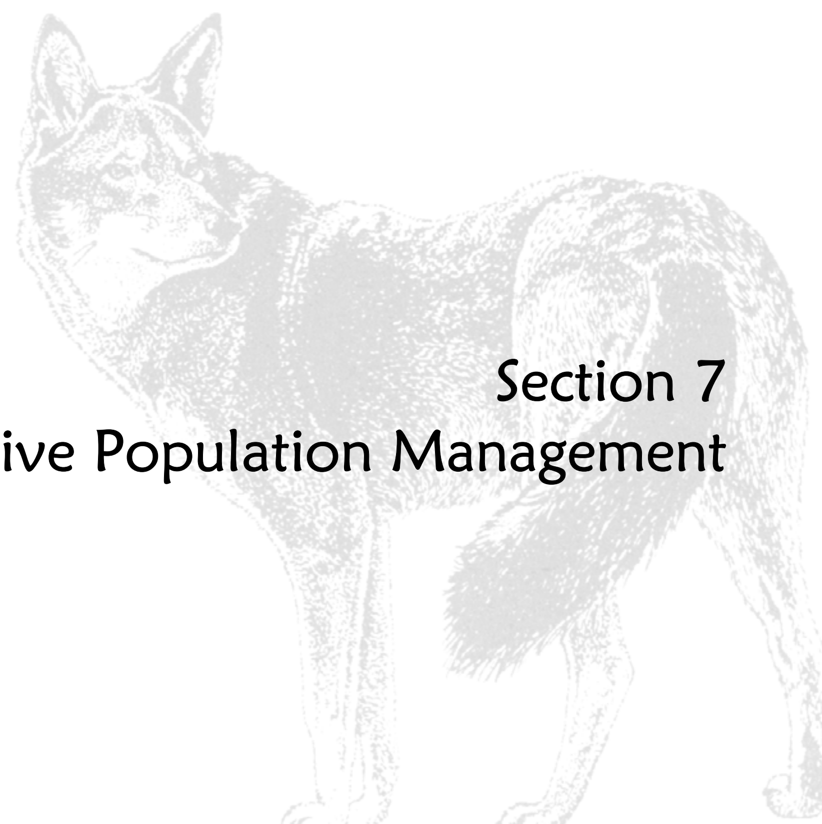
4. Form Recovery Plan revision team and reassess recovery plan within the next year.

Red Wolf

(Canis rufus)

Population and Habitat Viability Assessment (PHVA)

Virginia Beach, Virginia
13 - 16 April, 1999



Section 7
Captive Population Management

Captive Population Management Working Group Report

Working Group Members:
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Sue Lindsey, Wild Canid Survival and Research Center
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Kathy Traylor-Holzer, Minnesota Zoo (Facilitator)

Introduction

The role of the captive population in the recovery of the red wolf has changed over the last few years, as fewer wolves were needed for release. The focus of the American Zoo Association (AZA) Red Wolf Species Survival Plan (SSP) has shifted from breeding wolves for release to managing a stable captive population. This role also includes promoting the successes of the red wolf recovery program, the role of zoos in conservation, and the threats to wild canids and other top predators in North America. All of these are important and valid reasons for maintaining a captive population of red wolves in zoos, but the emphasis on these types of educational programs is a change from the original impetus to establish a captive breeding program for red wolves.

One fact became clear early in the workshop – that the role of the captive population in the recovery of red wolves had not diminished, but was becoming even more important than ever before. The hybridization of free-ranging red wolves with coyotes means that the captive population is the only repository of the original genetic composition of the species. Therefore, it was recognized that continued infusions of captive-bred wolves into the wild would be necessary to maintain hybrid-free populations of red wolves in the wild. As a result of the PHVA process, increased breeding of the captive populations and expansion of spaces for red wolves in zoos and other captive facilities has emerged as a critical need.

The processes that led to the recommendations in this report reflect the realization that the captive population has multiple roles to play in the recovery of the species. The working group was also very aware of the importance of careful application of scientific management of the captive population to ensure its survival, and the immediate need to produce captive-bred wolves that would be good candidates for release into the wild.

The group outlined nine major issues for the captive population:

1. Serve as a genetic and demographic reservoir
2. Ability to provide wolves for reintroduction
3. Use captive population for research to support wild population
4. Education/outreach
5. Need for captive population independent of recovery
6. Evaluate relative roles of captive population and changes over time
7. Space limitations
8. Captive management issues
9. Husbandry techniques to produce good release candidates (changes needed?)

Pairwise priority based on two separate criteria:

A. The captive population will be used to provide wolves for reintroduction;
B. The captive population will not be used for reintroduction.

Listing of issues according to priority:

A. Reintroduction	B. Captive population independent of wild
Release	Space limitations
Space limitations	Captive management
Reservoir	Captive population independent of wild
Captive management	Education
Husbandry techniques	Evaluation of roles
Evaluation of roles	Research
Research	Reservoir
Education	Husbandry techniques
Independent population	Release

Following discussion of these various roles for the captive population, the nine issues discussed above were reorganized into three major issue areas. Four roles for the captive population were identified to aid in the conservation of the red wolf. These are:

1) To maintain a genetic and demographically healthy captive population;
2) To supply wolves needed for release into the wild where appropriate; and
3) To conduct research to help investigate hybrid problems and questions.
4) To serve as a national voice for the recovery of red wolves independent of biological programs using educational outreach programs.

The Issues

The issues were further developed by producing a problem statement and definition, identifying needs for further information, establishing goals, determining actions and outlining outcomes that will constitute success for recovery of the red wolf.

1. Maintenance of an independent captive population

Overview statement: The captive population is the primary hedge against extinction of the red wolf. Because the wild population is being severely threatened by hybridization with coyotes, the captive population takes on an extraordinarily important role because it is the only repository of the original genetic representation of red wolves.

Definition - Management of a genetically and demographically healthy captive population. (Goal: retention of 83% gene diversity (expected heterozygosity) for 100 years)

The genetic goal for the population was determined by modeling the captive population using the captive population management software Drift (reference?). Various combinations of the parameters in the table below were assessed. Retaining 83% gene diversity (GD, also called expected heterozygosity) over 100 years came out as the best possible scenario and was taken as a reasonable goal for the captive population. The factors that produced 83% GD included increasing generation time (T), increasing under-represented founder lines through use of

assisted reproductive techniques, and increasing the current GD of the captive population. One clarification is in order: for the purposes of this exercise, new founders were taken as infusion of genetic material from underrepresented animals from semen banks and not as new animals from the wild.

Current Pop	Curr GD	Fdr lambda	T	lambda	Max Size	Min Size	# New Fnd	Ne/N	Length Prg	GD
166	.905	0	5.1	1.1	250	150	0	.3	100	79.7
166	.905	0	5.1	1.1	250	150	0	.3	200	69.7
166	.905	0	5.1	1.1	300	150	0	.3	100	81.4
166	.905	0	5.1	1.2	300	150	0	.3	100	81.4
166	.905	0	6.0	1.2	300	150	0	.3	100	82.8 *
166	.905	1.2	6.0	1.2	300	150	0	.3	100	83.3 *
166	.905	1.2	6.0	1.2	250	150	0	.3	100	81.8
166	.920	1.2	6.0	1.2	250	150	0	.3	100	83.0 *

Problem: Population size insufficient to achieve long-term management goals
Need: Increase AZA and non-AZA spaces
Goal: 250-300 spaces
Actions:

- Recruit additional cooperators targeting the historic range (emphasize the multiple roles of the captive population; further promote re-introduction program)
- Increase number of spaces at current facilities (new holding areas or restructure current holdings) – quality of space/exhibits may differ depending on the long term need of specific animals
- Maintain current facilities by surveying cooperators and targeting their program focus (e.g. breeding, research, outreach and education)

Outcomes:

Responsibility of SSP coordinator and management group

Timeline:

Intensify efforts immediately. (Timeline begins now (model included lambda of 1.2 or 20% growth per year which is around 40 new spaces per year and get to 300 population size in 5 years, if increase at 20 spaces per year (10%) take 6 years to 250 and 8 years to 300; if 10 spaces per year take 8 years to reach 250.)

Discussion:

Are all of these spaces to be in zoos? Is there a difference in breeding vs. exhibit space? A common practice is to have new facilities start with non-breeding group for a couple of years before moving to a breeding group. Non-AZA spaces will likely be needed because of the large number of spaces needed. Max that can be added per year is 20.

Problem: Unstable age structure due to lack of space to breed and uneven breeding success
Need: Increase breeding to stabilize age structure
Goal: Increase pup production to a lambda that will produce a stable age structure

Actions:

- Increase number of breeding recommendations per year; reproductive evaluations of individuals in unproductive pairs or those with low reproductive success (including fecal hormone analysis of males and females and semen analysis); examine husbandry, nutritional and environmental factors that could affect reproduction; increase space to accommodate increased production, consider culling as an option to increase space for stabilizing the population; be sure reproductive organs are included in necropsy protocol; look at past records to see if past hormone implant contraception may be contributing to lowered fertility.

Outcomes:

SSP management group and coordinator responsibility; discussions on culling would include input from the USFWS.

Problem: current generation time is contributing to an overly rapid loss of GD.
Need: slow rate of loss of genetic diversity in the captive population
Goal: increase generation time (T) from 5.1 to 6 years
Action:

- When males have similar mean kinship (MK), recommend the older animal for breeding; recommend separating sexes rather than MGA for contraception, so institutions should have facilities for separating sexes; continue to investigate the development of safe, effective and reversible contraceptives.

Outcomes:

SSP management group and coordinator responsibility in consort with the AZA Contraception SAG, timeline is now and ongoing; contraception study now being conducted and will continue, should have a good assessment of current tests within five years.

Problem: Genes from behavioral and physical non-breeders or dead animals that have rare genes are being lost from the captive population.
Need: increase genetic contribution of under-represented founder lines
Goal: develop reliable assisted reproduction techniques
Action:

- continue on-going research on semen freezing and timing ovulation;
- develop a Genome Resource Bank (GRB) action plan that would also include serum, tissue samples and cell lines from the wild and captive population;
- determine how much sperm from which individuals is banked, including data on post-thaw motility, bring this information to the Masterplan meeting and use it in modeling with *GENES* to evaluate effects on genetic diversity;
- identify a central location to house samples; funding is in place for the reproductive research portion of this initiative.

Outcomes:

SSP management group and coordinator responsibility. Will Waddell to bring information on banked semen to the Masterplan meeting, June 1999.

Problem: Current GD is lower than potential
Need: Increase GD of captive population
Goal: Move GD from current 90.5% to as close to potential of 94%

Action:

- Maximize increase of GD when picking breeding pairs

Outcome:

SSP management group and coordinator responsibility; timeline to use at next master plan meeting in June 99

<u>2. To supply wolves needed for release to augment wild population where and when appropriate.</u>

The captive population needs to provide periodic infusion of individuals into the wild population to support genetic integrity of the species in the wild at current or future release sites. These infusions can also be used to increase wild population sizes as a hedge against stochastic demographic events. A large number of individuals from the captive population may be needed for release into the wild as a way to address density dependent hybridization threats.

Discussion:

The suite of morphological features used to originally define the red wolf have not been figured for the current captive population. If they are going to be used to identify hybrids it could help to characterize the current captive population. One way to do this is to develop a phenotypic ID standard procedure to be used in the field as part of the experiment to correlate genetic and phenotypic markers. Data would be collected opportunistically. In order to be a valid procedure, a large number of wolves, coyotes and hybrids will need to be measured. It may be wise to bring someone from Alligator River to assess wolves at Graham to control for inter-observer differences that might negate measurement. In addition, central collection of photographs would be a valuable addition to the general red wolf information database; however, the problem is using phenotype to tell the difference between wolves and hybrids, especially F2,3 and so on. Since we are producing the hybrids already for genetic analysis, we may as well use them to see if there are conserved coyote physical traits that could be used as a marker for hybrids.

Overview statement: The captive population is the primary hedge against extinction of the red wolf. Because the wild population is being severely threatened by hybridization with coyotes, the captive population takes on an extraordinarily important role because it is the only repository of the original genetic representation of red wolves.

The captive population needs to provide periodic infusion of individuals into the wild population to support genetic integrity of the species in the wild at current or future release sites. These infusions can also be used to increase wild population sizes as a hedge against stocastic demographic events. A large number of individuals from the captive population may be needed for release into the wild as a way to address density dependent hybridization threats.

Problem: The gene diversity of the wild population is depauperate; the gene diversity of free ranging population is lower than potential and also lower than the captive population so there may be situations where animals are moved from the captive to wild population that can be used to augment the gene diversity of the wild population.

Need: To increase gene diversity of the wild population

Goal: Improve genetic diversity of the free ranging population without endangering the integrity of the captive population

Action:

- when wolves are requested for re-introduction: choose wolves for re-introduction that are under-represented in the wild; include this need when making breeding recommendations in the SSP master plan when possible; continue as a priority for the islands or mainland to set up pairs of underrepresented animals to produce offspring for release; monitor survival and reproduction of re-introduced animals to track any contributions to increasing GD

Outcome:

SSP coordinator and management group responsibility with Service determining the need for wolves for reintroduction; successful reproduction in the wild of release animals.

Demographic augmentation:

Releasing captive-born animals to increase the size of wild populations, increase density of wolves compared to coyotes, increase number of breeding age animals, fill in territories to exclude coyotes. This would be done regardless of the individual's representation in the captive population.

Problem: insufficient numbers of red wolves to prevent interbreeding with coyotes
Need: increase number of red wolves in NENC
Goal: Higher density of wolves
Action:

- Produce sufficient numbers of wolves in captive or island facilities for release (transferred animals responsibility of USFWS)

Problem: provide good release candidates
Need: released wolves need to survive to reproduction
Goals: maximize probability of survival and reproduction and minimize behavior that would result in the animal being removed from the wild (such as tolerance of people, depredation,)
Action:

- Give wolves experiences such as: opportunities to hunt, live in social group, introduce at a young age so they have less time in captivity, minimal contact with humans, experience with raising young or having reproduced themselves, and reared in larger, diverse enclosures; monitor after release to assess survival.

Outcome:

Improved survival and fewer removals from captive born released animals.

A): investigate mate choice as a technique for evaluating potential release candidates not only for the separate species, but for FI and backcross situations. **Action**: Move this to another category, i.e., changes in husbandry techniques to support release.

B): mate selection: look at red wolf's choice between wolf or coyote given equal opportunity. Does familiarity with coyotes influence choice of mate? Or, if one has testicles, one mates anything? Is age a factor? Produce aversion of wolves to mating with coyotes through conditioning? What about choice of wolves that have bred in captivity in choosing coyotes for mates? Do wolves choose coyotes on their first litter or later litters, when they lose a mate, when they lose a litter or fail to mate? Aversion training to odors that may affect mate choice?

Discussion of research role for captive population
From hybrid group: research needed to identify genetic markers to identify wolves, hybrids, and coyotes. Suggestion is that F1 hybrids are intermediate and can be separated from wolves and coyotes. Because species share genes it is a suite of genes, an F1 backcross may or may not be clearly one or the other, thus the research is needed.

Kinds of research and numbers of animals needed. Two issues at the same time: may have to raise a relatively large number of wolves for release while at the same time need space to do hybrid research. For first, zoos may be the spaces, other spaces from other institutions (not zoos) may be needed for research because zoos are not likely to be able to produce hybrids needed for research.

Do we know if hybrids are viable? Don't know. Red Wolf x Dog works, and red wolves and coyotes are closer. Have original hybrids now removed from the studbook. Need to look at fertility of hybrids. Wild may be better method because of numbers needed to answer the question. General feeling is that hybrids can breed, but we need to do the controlled study.

If question of space for wolves, Sandy Ridge could be used as an experimental station. Don't want to take a chance on any hybrids produced at sandy ridge contaminating alligator river population.

Space needs are common to all of the roles for the captive population (maintain, breed for release, and research). Need 33-40 spaces next year to grow at lambda 1.20.

Maintain -> zoos
Breed for release -> islands
Research -> sites other than zoos

<u>3. Research to investigate hybrid problems and questions.</u>

Problem: To identify wolves, coyotes and hybrids in the wild.
Need: A technique for identifying different species and hybrids in the wild
Goal: To be able to identify hybrid individuals and red wolves in wild population based on genetic and phenotypic markers (such as voice patterns, behavior, food habits, and morphology). Identification by inserting biomarkers is a possibility that should be explored.

Discussion:
To develop a way to identify wild canids by setting up known red wolf/coyote crosses to establish a genetic baseline for monitoring hybridization in the wild, including parental generation, F1s, backcrosses, F2s, other backcrosses. Minimum of three generations, 8 animals in each group. RWm x CF, Cm x RWf, 2x2. Take same numbers from litters to make up backcross, etc. Take 32 animals to do the study. Another question is time, may take two years before red wolves could reproduce. Will produce many more than are needed because litter size is larger than is needed just for the study. Could use animals produced for fertility/viability studies for genetic studies as well, but will still need to adress culling surplus animals. To look at fitness would take a large number of animals and may not be feasable or useful to use the captive population. May take too long to be useful in face of immediate challenge to the pop.

Investigations of dog x coyotes have been done. Research has been done in academic colonies, may be that this research will be most likely done in an academic setting. Ethical issues of producing animals that will be euthanized as part of research must be considered. Excess could also be used for behavioral research rather than be euthanized. It would be difficult for the zoo community to meet the needs for producing and housing hybrids because of limitations on space needed for maintaining the captive population and ethical issues of producing animals that would be surplus to cooperative breeding programs.

Action:

- examination of archival information
- identify individual researchers/group technical/scientific expertise
- at least one facility to carry out the research and find funding, and identify sufficient space,
- design and conduct crosses, estimating a minimum of 32 animals needed with 104 produced, use F1 hybrid progeny at Sandy Ridge as part of the study. (excess may be used in other studies).
- Ownership of animals will be retained by USFWS. Develop proactive position on usefulness of hybrid research.

> **Outcomes**: initiate first breedings for next breeding season (Jan 2000) with animals put together by Nov 1999. First round of genetic results needed by Oct 2000. Responsibility for initiating the process is with USFWS. USFWS develop a position statement prior to initiating breeding. Ethical issues -> conflicts with AZA guidelines (deliberate production of hybrids).

Problem: Mate selection: see mate selection above in section II

Problem: Hybrid fitness: difficult to test with captive population because of large numbers of animals needed to address the issues. Seman characteristics from captive males or captive females' cycles may indicate fitness.

Action:

- Use wolves produced to look at semen characteristics, estrous cycles, viability (juvenile mortality), litter size, sex ratio.

Problem: Crosses with grey wolf to look at evolutionary scenarios.

Comment:

Red x grey or grey x coyote crosses may be useful for evolutionary study: space is a issue for supplying wolves for maintaining the captive population, for release and for research projects directly aimed at recovery of the red wolf in the U.S., therefore using space for this type of study is not a priority use of that limited space. However, the captive population should continue to provide samples and support this research in ways it can.

List of Actions (prioritized based upon value to the conservation of the red wolf)

1. Provide additional spaces for captive red wolves by maintaining facilities, new facilities
2. Breed underrepresented animals
3. Produce additional wolves for release for demographic augmentation of the wild
4. Compile existing data from captive and captured wild animals
5. Deliberate production of hybrids to establish genetic and phenotypic baselines for fitness assessment
6. Monitor released animals for survival and reproduction
7. Produce additional wolves for release for genetic augmentation of wild
8. Provide minimal human contact, including choose young animals
9. Increase number of breeding recommendations
10. Provide hunting experience
11. Develop assisted reproduction techniques
12. Reproductive evaluation of under-represeented and low reproductive success animals
13. Develop GRB action plan and bank
14. Develop effective reversible contraception
15. Provide adequate enclosures for release conditions
16. Provide reproductive experience
17. Delay age of breeding
18. Evaluate mate preference of release candidates

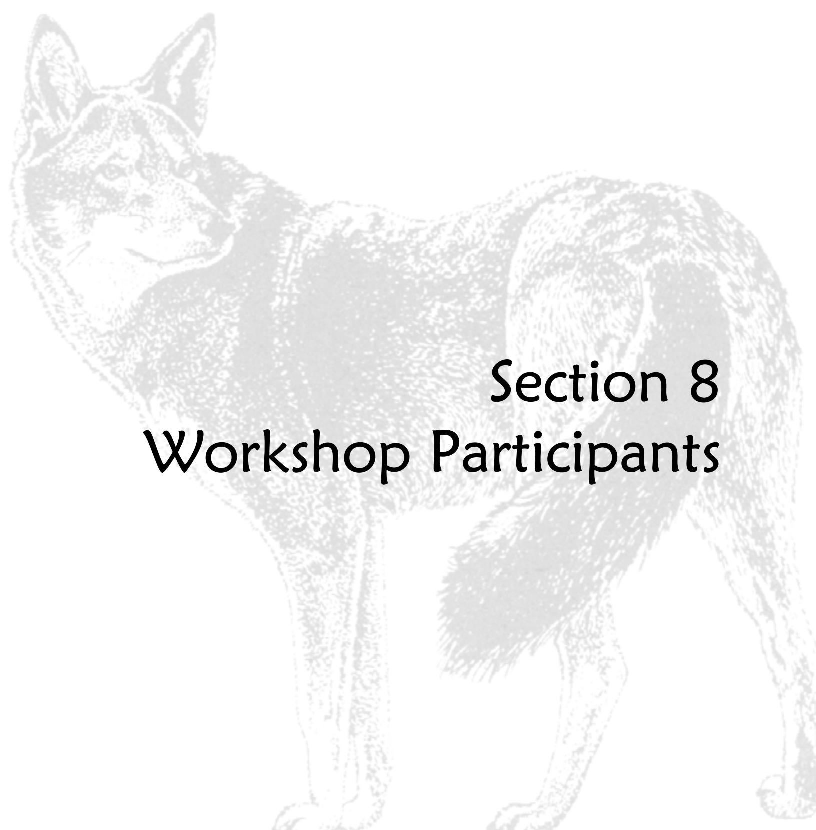
	Total	**Ranking**
Additional space	70	1
Breed under-represented wolves	63	2
Demographic supplementation	62	3.5
Compile database	62	3.5
Hybrid research study	59	5
Monitor released wolves	55	6
Genetic supplementation	53	7
Minimize human contact	51	8
Increase # of breedings	49	9
Hunting experience	41	10
AI techniques	34	11
Reproductive evaluation	33	12.5
GRB action plan	33	12.5
Contraception	30	14
Enclosure size and quality	27	15
Reproductive experience	26	16
Delay age of breeding	17	17
Evaluate mate preference	8	18

Red Wolf

(Canis rufus)

Population and Habitat Viability Assessment (PHVA)

Virginia Beach, Virginia
13 - 16 April, 1999



Section 8
Workshop Participants

Population and Habitat Viability Assessment (PHVA) for the Red Wolf *(Canis rufus)*: List of Workshop Participants

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Red Wolf

(Canis rufus)

Population and Habitat Viability Assessment (PHVA)

Virginia Beach, Virginia
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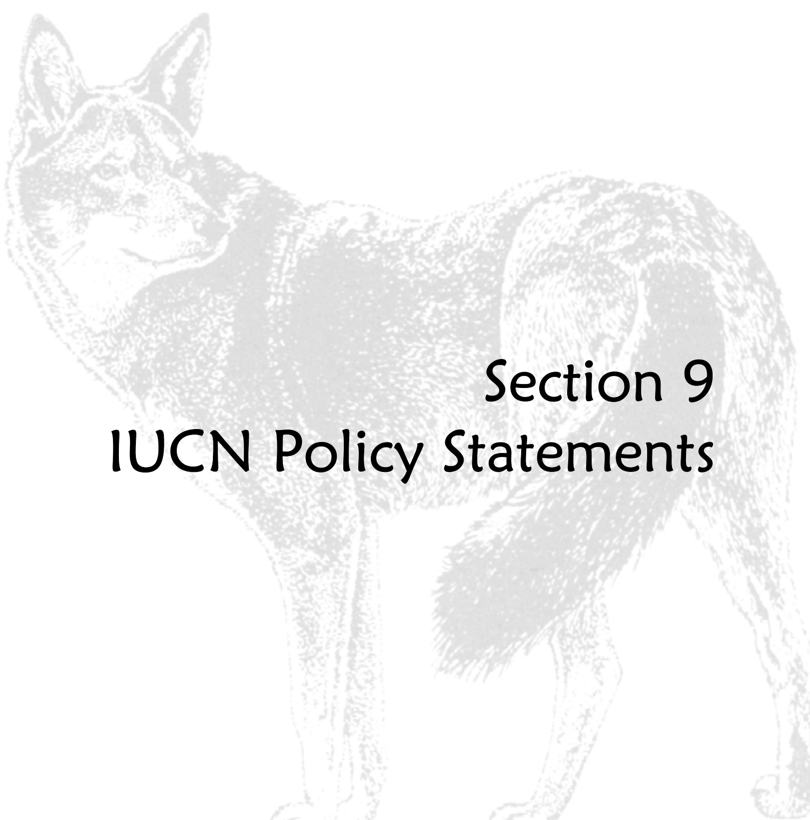

Section 9
IUCN Policy Statements

IUCN/SSC Guidelines For Re-Introductions

Prepared by the SSC Re-introduction Specialist Group *
Approved by the 41st Meeting of the IUCN Council, Gland Switzerland, May 1995

INTRODUCTION

These policy guidelines have been drafted by the Re-introduction Specialist Group of the IUCN's Species Survival Commission (1), in response to the increasing occurrence of re-introduction projects worldwide, and consequently, to the growing need for specific policy guidelines to help ensure that the re-introductions achieve their intended conservation benefit, and do not cause adverse side-effects of greater impact. Although IUCN developed a Position Statement on the Translocation of Living Organisms in 1987, more detailed guidelines were felt to be essential in providing more comprehensive coverage of the various factors involved in re-introduction exercises.

These guidelines are intended to act as a guide for procedures useful to re-introduction programmes and do not represent an inflexible code of conduct. Many of the points are more relevant to re-introductions using captive-bred individuals than to translocations of wild species. Others are especially relevant to globally endangered species with limited numbers of founders. Each re-introduction proposal should be rigorously reviewed on its individual merits. It should be noted that re-introduction is always a very lengthy, complex and expensive process.

Re-introductions or translocations of species for short-term, sporting or commercial purposes - where there is no intention to establish a viable population - are a different issue and beyond the scope of these guidelines. These include fishing and hunting activities.

This document has been written to encompass the full range of plant and animal taxa and is therefore general. It will be regularly revised. Handbooks for re-introducing individual groups of animals and plants will be developed in future.

CONTEXT

The increasing number of re-introductions and translocations led to the establishment of the IUCN/SSC Species Survival Commission's Re-introduction Specialist Group. A priority of the Group has been to update IUCN's 1987 Position Statement on the Translocation of Living Organisms, in consultation with IUCN's other commissions.

It is important that the Guidelines are implemented in the context of IUCN's broader policies pertaining to biodiversity conservation and sustainable management of natural resources. The philosophy for environmental conservation and management of IUCN and other conservation bodies is stated in key documents such as "Caring for the Earth" and "Global Biodiversity Strategy" which cover the broad themes of the need for approaches with community involvement and participation in sustainable natural resource conservation, an overall enhanced quality of human life and the need to conserve and, where necessary, restore ecosystems. With regards to the latter, the re-introduction of a species is one specific instance of restoration where, in general, only this species is missing. Full restoration of an array of plant and animal species has rarely been tried to date.

Restoration of single species of plants and animals is becoming more frequent around the world. Some succeed, many fail. As this form of ecological management is increasingly common, it is a priority for the Species Survival Commission's Re-introduction Specialist Group to develop guidelines so that re-introductions are both justifiable and likely to succeed, and that the conservation world can learn from each initiative, whether successful or not. It is hoped that these Guidelines, based on extensive review of

case - histories and wide consultation across a range of disciplines will introduce more rigour into the concepts, design, feasibility and implementation of re-introductions despite the wide diversity of species and conditions involved.

Thus the priority has been to develop guidelines that are of direct, practical assistance to those planning, approving or carrying out re-introductions. The primary audience of these guidelines is, therefore, the practitioners (usually managers or scientists), rather than decision makers in governments. Guidelines directed towards the latter group would inevitably have to go into greater depth on legal and policy issues.

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1. DEFINITION OF TERMS

"Re-introduction": an attempt to establish a species(2) in an area which was once part of its historical range, but from which it has been extirpated or become extinct (3) ("Re-establishment" is a synonym, but implies that the re-introduction has been successful).

"Translocation": deliberate and mediated movement of wild individuals or populations from one part of their range to another.

"Re-inforcement/Supplementation": addition of individuals to an existing population of conspecifics.

"Conservation/Benign Introductions": an attempt to establish a species, for the purpose of conservation, outside its recorded distribution but within an appropriate habitat and eco-geographical area. This is a feasible conservation tool only when there is no remaining area left within a species' historic range.

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2. AIMS AND OBJECTIVES OF RE-INTRODUCTION

a. Aims:
The principle aim of any re-introduction should be to establish a viable, free-ranging population in the wild, of a species, subspecies or race, which has become globally or locally extinct, or extirpated, in the wild. It should be re-introduced within the species' former natural habitat and range and should require minimal long-term management.

b. Objectives:
The objectives of a re-introduction may include: to enhance the long-term survival of a species; to re-establish a keystone species (in the ecological or cultural sense) in an ecosystem; to maintain and/or restore natural biodiversity; to provide long-term economic benefits to the local and/or national economy; to promote conservation awareness; or a combination of these.

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3. MULTIDISCIPLINARY APPROACH

A re-introduction requires a multidisciplinary approach involving a team of persons drawn from a variety of backgrounds. As well as government personnel, they may include persons from governmental natural resource management agencies; non-governmental organisations; funding bodies; universities; veterinary institutions; zoos (and private animal breeders) and/or botanic gardens, with a full range of suitable expertise. Team leaders should be responsible for coordination between the various bodies and provision should be made for publicity and public education about the project.

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4. PRE-PROJECT ACTIVITIES

4a. BIOLOGICAL

(i) Feasibility study and background research

- An assessment should be made of the taxonomic status of individuals to be re-introduced. They should preferably be of the same subspecies or race as those which were extirpated, unless adequate numbers are not available. An investigation of historical information about the loss and fate of individuals from the re-introduction area, as well as molecular genetic studies, should be undertaken in case of doubt as to individuals' taxonomic status. A study of genetic variation within and between populations of this and related taxa can also be helpful. Special care is needed when the population has long been extinct.
- Detailed studies should be made of the status and biology of wild populations(if they exist) to determine the species' critical needs. For animals, this would include descriptions of habitat preferences, intraspecific variation and adaptations to local ecological conditions, social behaviour, group composition, home range size, shelter and food requirements, foraging and feeding behaviour, predators and diseases. For migratory species, studies should include the potential migratory areas. For plants, it would include biotic and abiotic habitat requirements, dispersal mechanisms, reproductive biology, symbiotic relationships (e.g. with mycorrhizae, pollinators), insect pests and diseases. Overall, a firm knowledge of the natural history of the species in question is crucial to the entire re-introduction scheme.
- The species, if any, that has filled the void created by the loss of the species concerned, should be determined; an understanding of the effect the re-introduced species will have on the ecosystem is important for ascertaining the success of the re-introduced population.
- The build-up of the released population should be modelled under various sets of conditions, in order to specify the optimal number and composition of individuals to be released per year and the numbers of years necessary to promote establishment of a viable population.
- A Population and Habitat Viability Analysis will aid in identifying significant environmental and population variables and assessing their potential interactions, which would guide long-term population management.

(ii) Previous Re-introductions

- Thorough research into previous re-introductions of the same or similar species and wide-ranging contacts with persons having relevant expertise should be conducted prior to and while developing re-introduction protocol.

(iii) Choice of release site and type

- Site should be within the historic range of the species. For an initial re-inforcement there should be few remnant wild individuals. For a re-introduction, there should be no remnant population to prevent disease spread, social disruption and introduction of alien genes. In some circumstances, a re-introduction or re-inforcement may have to be made into an area which is fenced or otherwise delimited, but it should be within the species' former natural habitat and range.
- A conservation/ benign introduction should be undertaken only as a last resort when no opportunities for re-introduction into the original site or range exist and only when a significant contribution to the conservation of the species will result.
- The re-introduction area should have assured, long-term protection (whether formal or otherwise).

(iv) Evaluation of re-introduction site

- Availability of suitable habitat: re-introductions should only take place where the habitat and landscape requirements of the species are satisfied, and likely to be sustained for the for-seeable future. The possibility of natural habitat change since extirpation must be considered. Likewise, a change in the legal/ political or cultural environment since species extirpation needs to be ascertained and evaluated as a possible constraint. The area should have sufficient carrying capacity to sustain growth of the re-introduced population and support a viable (self-sustaining) population in the long run.

- Identification and elimination, or reduction to a sufficient level, of previous causes of decline: could include disease; over-hunting; over-collection; pollution; poisoning; competition with or predation by introduced species; habitat loss; adverse effects of earlier research or management programmes; competition with domestic livestock, which may be seasonal. Where the release site has undergone substantial degradation caused by human activity, a habitat restoration programme should be initiated before the re-introduction is carried out.

(v) Availability of suitable release stock

- It is desirable that source animals come from wild populations. If there is a choice of wild populations to supply founder stock for translocation, the source population should ideally be closely related genetically to the original native stock and show similar ecological characteristics (morphology, physiology, behaviour, habitat preference) to the original sub-population.

- Removal of individuals for re-introduction must not endanger the captive stock population or the wild source population. Stock must be guaranteed available on a regular and predictable basis, meeting specifications of the project protocol.

- Individuals should only be removed from a wild population after the effects of translocation on the donor population have been assessed, and after it is guaranteed that these effects will not be negative.

- If captive or artificially propagated stock is to be used, it must be from a population which has been soundly managed both demographically and genetically, according to the principles of contemporary conservation biology.

- Re-introductions should not be carried out merely because captive stocks exist, nor solely as a means of disposing of surplus stock.

- Prospective release stock, including stock that is a gift between governments, must be subjected to a thorough veterinary screening process before shipment from original source. Any animals found to be infected or which test positive for non-endemic or contagious pathogens with a potential impact on population levels, must be removed from the consignment, and the uninfected, negative remainder must be placed in strict quarantine for a suitable period before retest. If clear after retesting, the animals may be placed for shipment.

- Since infection with serious disease can be acquired during shipment, especially if this is intercontinental, great care must be taken to minimize this risk.

- Stock must meet all health regulations prescribed by the veterinary authorities of the recipient country and adequate provisions must be made for quarantine if necessary.

(vi) Release of captive stock

- Most species of mammal and birds rely heavily on individual experience and learning as juveniles for their survival; they should be given the opportunity to acquire the necessary information to

enable survival in the wild, through training in their captive environment; a captive bred individual's probability of survival should approximate that of a wild counterpart.

- Care should be taken to ensure that potentially dangerous captive bred animals (such as large carnivores or primates) are not so confident in the presence of humans that they might be a danger to local inhabitants and/or their livestock.

4b. SOCIO-ECONOMIC AND LEGAL REQUIREMENTS

- Re-introductions are generally long-term projects that require the commitment of long-term financial and political support.
- Socio-economic studies should be made to assess impacts, costs and benefits of the re-introduction programme to local human populations.
- A thorough assessment of attitudes of local people to the proposed project is necessary to ensure long term protection of the re-introduced population, especially if the cause of species' decline was due to human factors (e.g. over-hunting, over-collection, loss or alteration of habitat). The programme should be fully understood, accepted and supported by local communities.
- Where the security of the re-introduced population is at risk from human activities, measures should be taken to minimise these in the re-introduction area. If these measures are inadequate, the re-introduction should be abandoned or alternative release areas sought.
- The policy of the country to re-introductions and to the species concerned should be assessed. This might include checking existing provincial, national and international legislation and regulations, and provision of new measures and required permits as necessary.
- Re-introduction must take place with the full permission and involvement of all relevant government agencies of the recipient or host country. This is particularly important in re-introductions in border areas, or involving more than one state or when a re-introduced population can expand into other states, provinces or territories.
- If the species poses potential risk to life or property, these risks should be minimised and adequate provision made for compensation where necessary; where all other solutions fail, removal or destruction of the released individual should be considered. In the case of migratory/mobile species, provisions should be made for crossing of international/state boundaries.

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5. PLANNING, PREPARATION AND RELEASE STAGES

- Approval of relevant government agencies and land owners, and coordination with national and international conservation organizations.
- Construction of a multidisciplinary team with access to expert technical advice for all phases of the programme.
- Identification of short- and long-term success indicators and prediction of programme duration, in context of agreed aims and objectives.
- Securing adequate funding for all programme phases.
- Design of pre- and post- release monitoring programme so that each re-introduction is a carefully designed experiment, with the capability to test methodology with scientifically collected data.

Monitoring the health of individuals, as well as the survival, is important; intervention may be necessary if the situation proves unforseeably favourable.

- Appropriate health and genetic screening of release stock, including stock that is a gift between governments. Health screening of closely related species in the re-introduction area.
- If release stock is wild-caught, care must be taken to ensure that: a) the stock is free from infectious or contagious pathogens and parasites before shipment and b) the stock will not be exposed to vectors of disease agents which may be present at the release site (and absent at the source site) and to which it may have no acquired immunity.
- If vaccination prior to release, against local endemic or epidemic diseases of wild stock or domestic livestock at the release site, is deemed appropriate, this must be carried out during the "Preparation Stage" so as to allow sufficient time for the development of the required immunity.
- Appropriate veterinary or horticultural measures as required to ensure health of released stock throughout the programme. This is to include adequate quarantine arrangements, especially where founder stock travels far or crosses international boundaries to the release site.
- Development of transport plans for delivery of stock to the country and site of re-introduction, with special emphasis on ways to minimize stress on the individuals during transport.
- Determination of release strategy (acclimatization of release stock to release area; behavioural training - including hunting and feeding; group composition, number, release patterns and techniques; timing).
- Establishment of policies on interventions (see below).
- Development of conservation education for long-term support; professional training of individuals involved in the long-term programme; public relations through the mass media and in local community; involvement where possible of local people in the programme.
- The welfare of animals for release is of paramount concern through all these stages.

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6. POST-RELEASE ACTIVITIES

- Post release monitoring is required of all (or sample of) individuals. This most vital aspect may be by direct (e.g. tagging, telemetry) or indirect (e.g. spoor, informants) methods as suitable.
- Demographic, ecological and behavioural studies of released stock must be undertaken.
- Study of processes of long-term adaptation by individuals and the population.
- Collection and investigation of mortalities.
- Interventions (e.g. supplemental feeding; veterinary aid; horticultural aid) when necessary.
- Decisions for revision, rescheduling, or discontinuation of programme where necessary.
- Habitat protection or restoration to continue where necessary.
- Continuing public relations activities, including education and mass media coverage.
- Evaluation of cost-effectiveness and success of re- introduction techniques.
- Regular publications in scientific and popular literature.

Footnotes:

1. Guidelines for determining procedures for disposal of species confiscated in trade are being developed separately by IUCN.
2. The taxonomic unit referred to throughout the document is species; it may be a lower taxonomic unit (e.g. subspecies or race) as long as it can be unambiguously defined.
3. A taxon is extinct when there is no reasonable doubt that the last individual has died

The IUCN/SSC Re-introduction Specialist Group

The IUCN/SSC Re-introduction Specialist Group (RSG) is a disciplinary group (as opposed to most SSC Specialist Groups which deal with single taxonomic groups), covering a wide range of plant and animal species. The RSG has an extensive international network, a re-introduction projects database and re-introduction library. The RSG publishes a bi-annual newsletter RE-INTRODUCTION NEWS.

If you are a re-introduction practitioner or interested in re-introductions please contact:

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IUCN Position Statement on Translocation of Living Organisms:

INTRODUCTIONS, REINTRODUCTIONS AND RE-STOCKING

Prepared by the Species Survival Commission in collaboration with the Commission on Ecology, and the Commission on Environmental Policy, Law and Administration
Approved by the 22nd Meeting of the IUCN Council, Gland, Switzerland, 4 September 1987

FOREWORD

This statement sets out IUCN's position on translocation of living organisms, covering introductions, re-introductions and re-stocking. The implications of these three sorts of translocation are very different so the paper is divided into four parts dealing with Introductions, Re-introductions, Re-stocking and Administrative Implications, respectively.

DEFINITIONS:

Translocation is the movement of living organisms from one area with free release in another. The three main classes of translocation distinguished in this document are defined as follows:

- **Introduction** of an organism is the intentional or accidental dispersal by human agency of a living organism outside its historically known native range.
- **Re-introduction** of an organism is the intentional movement of an organism into a part of its native range from which it has disappeared or become extirpated in historic times as a result of human activities or natural catastrophe.
- **Re-stocking** is the movement of numbers of plants or animals of a species with the intention of building up the number of individuals of that species in an original habitat.

Translocations are powerful tools for the management of the natural and man made environment which, properly used, can bring great benefits to natural biological systems and to man, but like other powerful tools they have the potential to cause enormous damage if misused. This IUCN statement describes the advantageous uses of translocations and the work and precautions needed to avoid the disastrous consequences of poorly planned translocations.

PART I

INTRODUCTIONS

BACKGROUND

Non-native (exotic) species have been introduced into areas where they did not formerly exist for a variety of reasons, such as economic development, improvement of hunting and fishing, ornamentation, or maintenance of the cultures of migrated human communities. The damage done by harmful introductions to natural systems far outweighs the benefit derived from them. The introduction and establishment of alien species in areas where they did not formerly occur, as an accidental or intended result of human activities, has often been directly harmful to the native plants and animals of many parts of the world and to the welfare of mankind.

The establishment of introduced alien species has broken down the genetic isolation of communities of co-evolving species of plants and animals. Such isolation has been essential for the evolution and maintenance of the diversity of plants and animals composing the biological wealth of our planet. Disturbance of this isolation by alien species has interfered with the dynamics of natural systems causing the premature extinction of species. Especially successful and aggressive invasive species of plants and

animals increasingly dominate large areas having replaced diverse autochthonous communities. Islands, in the broad sense, including isolated biological systems such as lakes or isolated mountains, are especially vulnerable to introductions because their often simple ecosystems offer refuge for species that are not aggressive competitors. As a result of their isolation they are of special value because of high endemism (relatively large numbers of unique local forms) evolved under the particular conditions of these islands over a long period of time. These endemic species are often rare and highly specialised in their ecological requirements and may be remnants of extensive communities from bygone ages, as exemplified by the Pleistocene refugia of Africa and Amazonia.

The diversity of plants and animals in the natural world is becoming increasingly important to man as their demands on the natural world increase in both quantity and variety, notwithstanding their dependence on crops and domestic animals nurtured within an increasingly uniform artificial and consequently vulnerable agricultural environment.

Introductions, can be beneficial to man. Nevertheless the following sections define areas in which the introduction of alien organisms is not conducive to good management, and describe the sorts of decisions that should be made before introduction of an alien species is made.

To reduce the damaging impact of introductions on the balance of natural systems, governments should provide the legal authority and administrative support that will promote implementation of the following approach.

Intentional Introduction

General

1. Introduction of an alien species should only be considered if clear and well defined benefits to man or natural communities can be foreseen.
2. Introduction of an alien species should only be considered if no native species is considered suitable for the purpose for which the introduction is being made.

Introductions to Natural Habitats

3. No alien species should be deliberately introduced into any natural habitat, island, lake, sea, ocean or centre of endemism, whether within or beyond the limits of national jurisdiction. A natural habitat is defined as a habitat not perceptibly altered by man. Where it would be effective, such areas should be surrounded by a buffer zone sufficiently large to prevent unaided spread of alien species from nearby areas. No alien introduction should be made within the buffer zone if it is likely to spread into neighbouring natural areas.

Introduction into Semi-natural Habitat

4. No alien species should be introduced into a semi-natural habitat unless there are exceptional reasons for doing so , and only when the operation has been comprehensively investigated and carefully planned in advance. A semi-natural habitat is one which has been detectably changed by man's actions or one which is managed by man, but still resembles a natural habitat in the diversity of its species and the complexity of their interrelationships. This excludes arable farm land, planted ley pasture and timber plantations.

Introductions into Man-made Habitat

5. An assessment should be made of the effects on surrounding natural and semi-natural habitats of the introduction of any species, sub-species, or variety of plant to artificial, arable, ley pasture or other predominantly monocultural forest systems. Appropriate action should be taken to minimise negative effects.

Planning a Beneficial introduction

6. Essential features of investigation and planning consist of:
   - an assessment phase culminating in a decision on the desirability of the introduction;

- an experimental, controlled trial;
- the extensive introduction phase with monitoring and follow-up.

THE ASSESSMENT PHASE

Investigation and planning should take the following factors into account:

a) No species should be considered for introduction to a new habitat until the factors which limit its distribution and abundance in its native range have been thoroughly studied and understood by competent ecologists and its probable dispersal pattern appraised.

Special attention should be paid to the following questions:

- What is the probability of the exotic species increasing in numbers so that it causes damage to the environment, especially to the biotic community into which it will be introduced?
- What is the probability that the exotic species will spread and invade habitats besides those into which the introduction is planned? Special attention should be paid to the exotic species' mode of dispersal.
- How will the introduction of the exotic proceed during all phases of the biological and climatic cycles of the area where the introduction is planned? It has been found that fire, drought and flood can greatly alter the rate of propagation and spread of plants.
- What is the capacity of the species to eradicate or reduce native species by interbreeding with them?
- Will an exotic plant interbreed with a native species to produce new species of aggressive polyploid invader? Polyploid plants often have the capacity to produce varied offspring some of which quickly adapt to and dominate, native floras and cultivars alike.
- Is the alien species the host to diseases or parasites communicable to other flora and fauna, man, their crops or domestic animals, in the area of introduction?
- What is the probability that the species to be introduced will threaten the continued existence or stability of populations of native species, whether as a predator, competitor for food, cover, breeding sites or in any other way? If the introduced species is a carnivore, parasite or specialised herbivore, it should not be introduced if its food includes rare native species that could be adversely affected.

b) There are special problems to be considered associated with the introduction of aquatic species. These species have a special potential for invasive spread.

- Many fish change trophic level or diet preference following introduction, making prediction of the results of the re-introduction difficult. Introduction of a fish or other species at one point on a river system or into the sea may lead to the spread of the species throughout the system or area with unpredictable consequences for native animals and plants. Flooding may transport introduced species from one river system to another.
- introduced fish and large aquatic invertebrates have shown a great capacity to disrupt natural systems as their larval, sub-adult and adult forms often use different parts of the same natural system.

c) No introduction should be made for which a control does not exist or is not possible. A risk-and-threat analysis should be undertaken including investigation of the availability of methods for the control of the introduction should it expand in a way not predicted or have unpredicted undesirable effects, and the methods of control should be socially acceptable, efficient, should not damage vegetation and fauna, man, his domestic animals or cultivars.

d) When the questions above have been answered and the problems carefully considered, it should be decided if the species can reasonably be expected to survive in its new habitat, and if so, if it can

reasonably be expected to enhance the flora and fauna of the area, or the economic or aesthetic value of the area, and whether these benefits outweigh the possible disadvantages revealed by the investigations.

THE EXPERIMENTAL CONTROLLED TRIAL

Following a decision to introduce a species, a controlled experimental introduction should be made observing the following advice:

- Test plants and animals should be from the same stock as those intended to be extensively introduced.
- They should be free of diseases and parasites communicable to native species, man, his crops and domestic livestock.
- The introduced species' performance on parameters in 'the Assessment Phase' above should be compared with the pre-trial assessment, and the suitability of the species for introduction should be reviewed in light of the comparison.

THE EXTENSIVE INTRODUCTION

If the introduced species behaves as predicted under the experimental conditions, then extensive introductions may commence but should be closely monitored. Arrangements should be made to apply counter measures to restrict, control, or eradicate the species if necessary.

The results of all phases of the introduction operation should be made public and available to scientists and others interested in the problems of introductions.

The persons or organisation introducing the species, not the public, should bear the cost of control of introduced organisms and appropriate legislation should reflect this.

ACCIDENTAL INTRODUCTIONS

1. Accidental introductions of species are difficult to predict and monitor, nevertheless they "should be discouraged where possible. The following actions are particularly important:
    - On island reserves, including isolated habitats such as lakes, mountain tops and isolated forests, and in wilderness areas, special care should be taken to avoid accidental introductions of seeds of alien plants on shoes and clothing and the introduction of animals especially associated with man, such as cats, dogs, rats and mice.
    - Measures, including legal measures, should be taken to discourage the escape of farmed, including captive-bred, alien wild animals and newly-domesticated species which could breed with their wild ancestors if they escaped.
    - In the interest of both agriculture and wildlife, measures should be taken to control contamination of imported agricultural seed with seeds of weeds and invasive plants.
    - Where large civil engineering projects are envisaged, such as canals, which would link different biogeographical zones, the implications of the linkage for mixing the fauna and flora of the two regions should be carefully considered. An example of this is the mixing of species from the Pacific and Caribbean via the Panama Canal, and the mixing of Red Sea and Mediterranean aquatic organisms via the Suez Canal. Work needs to be done to consider what measures can be taken to restrict mixing of species from different zones through such large developments.

2. Where an accidentally introduced alien successfully and conspicuously propagates itself, the balance of its positive and negative economic and ecological effects should be investigated. If the overall effect is negative, measures should be taken to restrict its spread.

WHERE ALIEN SPECIES ARE ALREADY PRESENT

1. In general, introductions of no apparent benefit to man, but which are having a negative effect on the native flora and fauna into which they have been introduced, should be removed or eradicated. The present ubiquity of introduced species will put effective action against the majority of invasives beyond the means of many States but special efforts should be made to eradicate introductions on:
   - islands with a high percentage of endemics in the flora and fauna;
   - areas which are centres of endemism;
   - areas with a high degree of species diversity;
   - areas with a high degree of other ecological diversity;
   - areas in which a threatened endemic is jeopardised by the presence of the alien.
2. Special attention should be paid to feral animals. These can be some of the most aggressive and damaging alien species to the natural environment, but may have value as an economic or genetic resource in their own right, or be of scientific interest. Where a feral population is believed to have a value in its own right, but is associated with changes in the balance of native vegetation and fauna, the conservation of the native flora and fauna should always take precedence. Removal to captivity or domestication is a valid alternative for the conservation of valuable feral animals consistent with the phase of their evolution as domestic animals.

   Special attention should be paid to the eradication of mammalian feral predators from areas where there are populations of breeding birds or other important populations of wild fauna. Predatory mammals are especially difficult, and sometimes impossible to eradicate, for example, feral cats, dogs, mink, and ferrets.
3. In general, because of the complexity and size of the problem, but especially where feral mammals or several plant invaders are involved, expert advice should be sought on eradication.

BIOLOGICAL CONTROL

1. Biological control of introductions has shown itself to be an effective way of controlling and eradicating introduced species of plants and more rarely, of animals. As biological control involves introduction of alien species, the same care and procedures should be used as with other intentional introductions.

MICRO-ORGANISMS

1. There has recently been an increase of interest in the use of micro-organisms for a wide variety of purposes including those genetically altered by man.
   Where such uses involve the movement of micro-organisms to areas where they did not formerly exist, the same care and procedures should be used as set out above for other species.

THE RE-INTRODUCTION OF SPECIES*

Re-introduction is the release of a species of animal or plant into an area in which it was indigenous before extermination by human activities or natural catastrophe. Re-introduction is a particularly useful tool for restoring a species to an original habitat where it has become extinct due to human persecution, over-collecting, over-harvesting or habitat deterioration, but where these factors can now be controlled. Re-introductions should only take place where the original causes of extinction have been removed. Re-introductions should only take place where the habitat requirements of the species are satisfied. There should be no re-introduction if a species became extinct because of habitat change which remains unremedied, or where significant habitat deterioration has occurred since the extinction.

The species should only be re-introduced if measures have been taken to reconstitute the habitat to a state suitable for the species.

The basic programme for re-introduction should consist of:

- a feasibility study;
- a preparation phase;
- release or introduction phase; and a
- follow-up phase.

THE FEASIBILITY STUDY

An ecological study should assess the previous relationship of the species to the habitat into which the re-introduction is to take place, and the extent that the habitat has changed since the local extinction of the species. If individuals to be re-introduced have been captive-bred or cultivated, changes in the species should also be taken into account and allowances made for new features liable to affect the ability of the animal or plant to re-adapt to its traditional habitat.

The attitudes of local people must be taken into account especially if the reintroduction of a species that was persecuted, over-hunted or over collected , is proposed. If the attitude of local people is unfavorable an education and interpretive programme emphasizing the benefits to them of the re-introduction, or other inducement, should be used to improve their attitude before re-introduction takes place.

The animals or plants involved in the re-introduction must be of the closest available race or type to the original stock and preferably be the same race as that previously occurring in the area.

Before commencing a re-introduction project, sufficient funds must be available to ensure that the project can be completed, including the follow-up phase.

THE PREPARATION AND RELEASE OR INTRODUCTORY PHASES

The successful re-introduction of an animal or plant requires that the biological needs of the species be fulfilled in the area where the release is planned. This requires a detailed knowledge of both the needs of the animal or plant and the ecological dynamics of the area of re-introduction. For this reason the best available scientific advice should be taken at all stages of a species re-introduction.

This need for clear analysis of a number of factors can be clearly seen with reference to introductions of ungulates such as ibex, antelope and deer where re-introduction involves understanding and applying the significance of factors such as the ideal age for re-introducing individuals, ideal sex ratio, season, specifying capture techniques and mode of transport to re-introduction site, freedom of both the species and the area of introduction from disease and parasites, acclimatisation, helping animals to learn to forage

in the wild, adjustment of the gut flora to deal with new forage, 'imprinting' on the home range, prevention of wandering of individuals from the site of re-introduction, and on-site breeding in enclosures before release to expand the released population and acclimatise the animals to the site. The re-introduction of other taxa of plants and animals can be expected to be similarly complex.

FOLLOW-UP PHASE

Monitoring of released animals must be an integral part of any re-introduction programme. Where possible there should be long-term research to determine the rate of adaptation and dispersal, the need for further releases and identification of the reasons for success or failure of the programme.

The species impact on the habitat should be monitored and any action needed to improve conditions identified and taken.

Efforts should be made to make available information on both successful and unsuccessful re-introduction programmed through publications, seminars and other communications.

PART III

RESTOCKING

1. Restocking is the release of a plant or animal species into an area in which it is already present. Restocking may be a useful tool where:
    - it is feared that a small reduced population is becoming dangerously inbred; or
    - where a population has dropped below critical levels and recovery by natural growth will be dangerously slow; or
    - where artificial exchange and artificially-high rates of immigration are required to maintain outbreeding between small isolated populations on biogeographical islands.
2. In such cases care should be taken to ensure that the apparent nonviability of the population, results from the genetic institution of the population and not from poor species management which has allowed deterioration in the habitat or over-utilisation of the population. With good management of a population the need for re-stocking should be avoidable but where re-stocking is contemplated the following points should be observed:

    a) Restocking with the aim of conserving a dangerously reduced population should only be attempted when the causes of the reduction have been largely removed and natural increase can be excluded.

    b) Before deciding if restocking is necessary, the capacity of the area it is proposed to restock should be investigated to assess if the level of the population desired is sustainable. If it is, then further work should be undertaken to discover the reasons for the existing low population levels. Action should then be taken to help the resident population expand to the desired level. Only if this fails should restocking be used.
3. Where there are compelling reasons for restocking the following points should be observed.

    a) Attention should be paid to the genetic constitution of stocks used for restocking.

    - In general, genetic manipulation of wild stocks should be kept to a minimum as it may adversely affect the ability of a species or population to survive. Such manipulations

modify the effects of natural selection and ultimately the nature of the species and its ability to survive.

- Genetically impoverished or cloned stocks should not be used to re-stock populations as their ability to survive would be limited by their genetic homogeneity.

b) The animals or plants being used for re-stocking must be of the same race as those in the population into which they are released.

c) Where a species has an extensive natural range and restocking has the aim of conserving a dangerously reduced population at the climatic or ecological edge of its range, care should be taken that only individuals from a similar climatic or ecological zone are used since interbreeding with individuals from an area with a milder climate may interfere with resistant and hardy genotypes on the population's edge.

d) Introduction of stock from zoos may be appropriate, but the breeding history and origin of the animals should be known and follow as closely as possible Assessment Phase guidelines a, b, c and d (see pages 5-7). In addition the dangers of introducing new diseases into wild populations must be avoided: this is particularly important with primates that may carry human zoonoses.

e) Restocking as part of a sustainable use of a resource (e.g. release of a proportion of crocodiles hatched from eggs taken from farms) should follow guidelines a and b (above).

f) Where restocking is contemplated as a humanitarian effort to release or rehabilitate captive animals it is safer to make such releases as re-introductions where there is no danger of infecting wild populations of the same species with new diseases and where there are no problems of animals having to be socially accepted by wild individuals of the species.

PART IV

NATIONAL, INTERNATIONAL AND SCIENTIFIC IMPLICATIONS OF TRANSLOCATIONS

NATIONAL ADMINISTRATION

1. Pre-existing governmental administrative structures and frameworks already in use to protect agriculture, primary industries, wilderness and national parks should be used by governments to control both intentional and unintentional importation of organisms, especially through use of plant and animal quarantine regulations.
2. Governments should set up or utilise pre-existing scientific management authorities or experts in the fields of biology, ecology and natural resource management to advise them on policy matters concerning translocations and on individual cases where an introduction, re-introduction or restocking or farming of wild species is proposed.
3. Governments should formulate national policies on:
    - translocation of wild species;
    - capture and transport of wild animals;
    - artificial propagation of threatened species;
    - selection and propagation of wild species for domestication; and

- prevention and control of invasive alien species.

4. At the national level legislation is required to curtail introductions:

   Deliberate introductions should be subject to a permit system. The system should apply not only to species introduced from abroad but also to native species introduced to a new area in the same country. It should also apply to restocking.

   Accidental introductions

   - for all potentially harmful organisms there should be a prohibition to import them and to trade in them except under a permit and under very stringent conditions. This should apply in particular to the pet trade;
   - where a potentially harmful organism is captive bred for commercial purposes (e.g. mink) there should be established by legislation strict standards for the design and operation of the captive breeding facilities. In particular, procedures should be established for the disposal of the stock of animals in the event of a discontinuation of the captive breeding operation;
   - there should be strict controls on the use of live fish bait to avoid inadvertent introductions of species into water where they do not naturally occur.

   Penalties

5. Deliberate introductions without a permit as well as negligence resulting in the escape or introduction of species harmful to the environment should be considered criminal offences and punished accordingly. The author of a deliberate introduction without a permit or the person responsible for an introduction by negligence should be legally liable for the damage incurred and should in particular bear the costs of eradication measures and of habitat restoration where required.

INTERNATIONAL ADMINISTRATION

Movement of Introduced Species Across International Boundaries

1. Special care should be taken to prevent introduced species from crossing the borders of a neighboring state. When such an occurence is probable, the neighboring state should be promptly warned and consultations should be held in order to take adequate measures.

   The Stockholm Declaration

2. According to Principle 21 of the Stockholm Declaration on the Human Environment, states have the responsibility 'to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states'.

   International Codes of Practice, Treaties and Agreements

3. States should be aware of the following international agreements and documents relevant to translocation of species:
   - ICES, Revised Code of Practice to Reduce the Risks from introduction of Marine Species, 1982.
   - FAO, Report of the Expert Consultation on the Genetic Resources of Fish, Recommendations to Governments No L 1980.
   - EIFAC (European Inland Fisheries Advisory Commission), Report of the Working Party on Stock Enhancement, Hamburg, FRG 1983.

- The Bonn Convention MSC: Guidelines for Agreements under the Convention.
- The Berne Convention: the Convention on the Conservation of European wildlife and Natural Habitats.
- The ASEAN Agreement on the Conservation of Nature and Natural Resources.
- Law of the Sea Convention, article 196.
- Protocol on Protected Areas and Wild Fauna and Flora in Eastern African Region.

In addition to the international agreements and documents cited, States also should be aware of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). International shipments of endangered or threatened species listed in the Appendices to the Convention are subject to CITES regulation and permit requirements. Enquiries should be addressed to: CITES Secretariat**, Case Postale 456, CH-1219 Chatelaine, Genève, Switzerland; telephone: 41/22/979 9149, fax: 41/22/797 3417.

Regional Development Plans

4. International, regional or country development and conservation organisations, when considering international, regional or country conservation strategies or plans, should include in-depth studies of the impact and influence of introduced alien species and recommend appropriate action to ameliorate or bring to an end their negative effects.

Scientific Work Needed

5. A synthesis of current knowledge on introductions, re-introductions and re-stocking is needed.

6. Research is needed on effective, target specific, humane and socially acceptable methods of eradication and control of invasive alien species.

7. The implementation of effective action on introductions, re-introductions and re-stocking frequently requires judgements on the genetic similarity of different stocks of a species of plant or animal. More research is needed on ways of defining and classifying genetic types.

8. Research is needed on the way in which plants and animals are dispersed through the agency of man (dispersal vector analysis).

A review is needed of the scope, content and effectiveness of existing legislation relating to introductions.

IUCN Responsibilities

International organisations, such as UNEP, UNESCO and FAO, as well as states planning to introduce, re-introduce or restock taxa in their territories, should provide sufficient funds, so that IUCN as an international independent body, can do the work set out below and accept the accompanying responsibilities.

9. IUCN will encourage collection of information on all aspects of introductions, re-introductions and restocking, but especially on the case histories of re-introductions; on habitats especially vulnerable to invasion; and notable aggressive invasive species of plants and animals.

Such information would include information in the following categories:

- a bibliography of the invasive species;
- the taxonomy of the species;
- the synecology of the species; and
- methods of control of the species.

10. The work of the Threatened Plants Unit of IUCN defining areas of high plant endemism, diversity and ecological diversity should be encouraged so that guidance on implementing recommendations in this document may be available.
11. A list of expert advisors on control and eradication of alien species should be available through IUCN.

Note:
* The section on re-introduction of species has been enhanced by the Guidelines For Re-Introductions
** The address of the CITES Secretariat has been updated.

United States Government
MEMORANDUM

DATE: **November 23, 1998**

REPLY TO ATTENTION OF : **Brian T. Kelly, Red Wolf Field Projects Coordinator, Manteo, NC**

SUBJECT: **Requests to remove non-problem wolves from private land**

TO: **Art Beyer, Wildlife Biologist, ARNWR, Manteo, NC**
Michael Morse, Wildlife Biologist, ARNWR, Manteo, NC
Jennifer Gilbreath, Wildlife Biologist, ARNWR, Manteo, NC

I want to follow-up and clarify my comments from our discussion at last week's staff meeting regarding the above subject. As we discussed, there are several reasons for again trapping Lux Farms (and thus other private landowners who request we remove wolves that are not causing a problem). However, in the absence of a finished work plan, I wanted to elaborate, in writing, why fulfilling these requests are troublesome to our program.

In both a book chapter discussing threats to endangered species recovery, and at the recent conference in Seattle, I articulated 2 primary threats to recovering the red wolf. First, is hybridization. Second, is public acceptance of wolves, in particular our current rules that allow landowners to request the removal of wolves without an associated problem. The threat hybridization represents to recovery will depend on a variety of factors, some of which will require data that we currently do not have. Our rules represent a threat for 3 reasons: (1) they require significant manpower to sustain the effort, (2) such removals have an unknown effect on aiding coyote colonization and hybridization, and (3) by removing wolves that are established and not causing a problem we are slowing the establishment of a red wolf population. Although all represent threats, (1) and (2) are potentially very serious. With manpower diverted to these requests, we can't collect the data we need to assess the hybridization threat, nor can we adequately address normal population monitoring tasks. If removing wolves contributes in some way to hybridization, which in theory it could, we are contributing to the hybridization of the northeastern NC red wolf population by our own actions. Thus our rules may be significantly compromising the sustainability of this landmark program. Hence, my frustration regarding our obligation to respond to such requests. We are charged with conducting red wolf ***recovery*** and the fact that our own actions may be detrimental to that goal troubles me, especially since it is for no reason that serves the public good but instead appears only to serve the economic interest of a few landowners.

cc: Chris Lucash, Red Wolf Recovery, Townsend, TN

United States Government
MEMORANDUM

DATE: **December 1, 1998**

REPLY TO ATTENTION OF: **Brian T. Kelly, Red Wolf Field Projects Coordinator, Manteo, NC** BTK

SUBJECT: **Take provision of our rules**

TO: **V. Gary Henry, Red Wolf Recovery Coordinator, Asheville, NC**

After discussing the issue with the field crew and consulting with Jack Baker, I have, at this time, decided not to issue a letter giving permission to Lux Farms to take (trap) wolves off of their land. The primary reason for this is a concern over what such a letter may mean for red wolf recovery in NENC. Once we issue a letter to Lux Farms, I am concerned that others who have requested wolves be removed will want similar permission. Furthermore, I am concerned how landowners who are "on the fence" with respect to our program will react to the potential to be granted such permission. While it is true the issuance of such a letter is up to us and is not guaranteed, a set of defendable criteria for who is granted permission and who is not is problematic. Also, once the "cat is out of the bag" it is certainly possible that we will get more requests for removal. I cannot justify the potential risk this represents to what we have accomplished in NENC the past 11 years. On one hand, granting permission to landowners to take wolves would allow the field crew to focus on recovery. However, on the other hand, I am troubled by the potential impact such removals will have on hybridization and on the stability and sustainability of the only free ranging red wolf population.

I have attached a memo I recently wrote to the field crew that elaborates on my concerns about the effect such removals may have on our ability to recover this species. This morning Art and Michael caught a coyote on Lux Farms. Although not proof of the effect of such removals, the occurrence of a coyote in an area that we removed several wolves from last year, and traditionally had not caught coyotes in, is consistent with the idea that such removals contribute to the colonization of coyotes in NENC which then contributes to hybridization between coyotes and red wolves. Therefore, our current rules as they relate to removing wolves from private land simply because they are present is likely contributing to what we all agree is the biggest threat to red wolf recovery–hybridization. We need to resolve to change our regulations to reflect that we will remove wolves only when there is an associated problem such as a depredation.

We need to change our rules. Our program has evolved dramatically since the time of the original reintroduction. The paradigm by which we operate needs to change if we are to move forward effectively with recovery. We all agreed that there are several major issues facing recovery (hybridization, new site, and monitoring . . . among others). We cannot adequately address such issues while at the same time responding to requests to remove wolves from private land that are not causing a problem; and should not issue letters for take given the detrimental effect it may have on the red wolf recovery.

cc: M. Bryant, Manager, Alligator River NWR, Manteo, NC
Chris Lucash, Red Wolf Recovery, Townsend, TN
Red Wolf Crew, Alligator River NWR, Manteo, NC

United States Government
MEMORANDUM

DATE: **January 28, 1999**

REPLY TO ATTENTION OF: **Brian T. Kelly, Red Wolf Field Coordinator, Manteo, NC**

SUBJECT: **Interpretation of Red Wolf Rules**

TO: **John Ebersole, DOI Solicitor, Atlanta, GA**
V. Gary Henry, Red Wolf Recovery Coordinator, Asheville, NC
Jack Baker, USFWS Special Agent, Washington, NC

As Gary articulated in his briefing statement for our meeting in Manteo on January 21, two sections of the current red wolf rule apply to situations where landowners would like wolves removed from their land when no depredation exists. That is, situations where landowners want wolves removed simply because wolves are present. Those 2 sections follow:

> **"(c)(4)(v) Any private landowner may take red wolves found on his or her property . . . after efforts by project personnel to capture such animals have been abandoned, *Provided* that the Service project leader or biologist has approved such actions in writing and all such taking shall be reported within 24 hours . . ."**
>
> **"(10) . . . Any animal . . . that moves onto lands where the landowner requests their removal will be recaptured, *if possible*, . . . Such animals will be released back into the wild as soon as possible, . . ."**

With respect to (c)(4)(v), the pre-amble to the current rule refers to granting written permission to a landowner to take wolves in the context of a depredation. This, combined with the fact that we have refused a request for such permission because there was no depredation supports the interpretation that (c)(4)(v) applies only to situations where a problem exists (see attached for definition of a problem).

With this interpretation of (c)(4)(v), section (10) is the only remaining section of the current red wolf rule that applies when a landowner requests removal of wolves that are not causing a problem. In section (10), the term "*if possible*" provides latitude with respect to the Service's efforts to fulfill such requests. It is clear now, eleven years after reintroduction, with a population of wolves estimated at 75 or more, that it is not possible to capture and keep wolves from a specific tract of land. Such removals may also contribute to hybridization with coyotes.

Please review the attached guidelines the red wolf field crew will follow to address all subsequent requests to remove wolves that are not causing a problem. I will follow-up via phone to inquire if everyone supports these guidelines. Gary, I will defer to you whether we need to inform the RO that we are implementing this interpretation of our current rule.

cc: M. Bryant, Manager, ARNWR, Manteo, NC

United States Government
MEMORANDUM

DATE: **February 5, 1999**

REPLY TO ATTENTION OF : **Brian T. Kelly**

SUBJECT: **Guidelines for Applying Red Wolf Rules**

TO: **Jim Savery, Manager, Pocosin Lakes NWR, Creswell, NC**
Don Temple, Manager, Mattamuskeet NWR, Swan Quarter, NC

Attached please find the guidelines for applying the current red wolf rule. These guidelines are the result of our January meeting and have been crafted in close collaboration with John Ebersole our ES solicitor.

I have also attached a copy of a memo that provides the justification for the attached guidelines. Gary is preparing a briefing statement on these guidelines for the regional office. We have applied these guidelines and removed traps from a farm we were trapping to remove non-problems wolves.

Thank you again for your help in the January meeting.

cc: Michael Bryant, Manager, Alligator River NWR, Manteo, NC
V. Gary Henry, Recovery Coordinator, Asheville, NC
J. Baker, USFWS Special Agent, Washington, NC

Guidelines For Applying The Current Red Wolf Rule (April 13, 1995) To Requests To Remove red wolves from private land.

(Effective January 28, 1999)

REMOVAL OF WOLVES THAT ARE CAUSING A PROBLEM

A ***PROBLEM*** with respect to the potential issuance of written permission for a landowner to take a red wolf is defined as:

1. Any situation where the loss of personal property (e.g., livestock, pets) is directly caused by the actions of a red wolf, or
2. A wolf exhibiting inappropriate behavior, such as tolerance of people or dwellings, that suggests it may become a more serious problem.

Guidelines

When a report of a red wolf caused problem is received, field personnel will respond within 48 hours. Field personnel will attempt to determine if a wolf is indeed responsible for the reported problem. If so, the capture and removal of the offending animal, or the application of some behavioral modification technique, may be attempted. If capture is not successful or feasible, lethal means could be employed or written permission may be provided according to the specifications provided in the current red wolf rule.

Justification

The current red wolf rule articulates our required response and the potential for granting written permission to take depredating (PROBLEM definition #1 above) wolves. The use of behavioral modification is a non-lethal means by which certain problems related to undesirable behaviors (definition #2 above) may be resolved.

REMOVAL OF WOLVES THAT ARE *NOT* CAUSING A PROBLEM

Guidelines:

When a request is received to remove non-problem wolves, the red wolf field crew will respond, if manpower permits, to the landowner's request, to assess the situation and determine if efforts to capture such wolves are warranted. Traps may or may not be set to attempt to capture non-problem wolves. The criteria upon which this decision will be made include: the history of problems in the area in question, available manpower, presence of wolf or other wild canid sign (feces, tracks), the history of wolf or other canid presence in the area in question, and the known presence of a wolf or other wild canid in the area based on radio telemetry data.

Justification:

The section of the red wolf rule that applies to these types of requests specifies we will recapture such wolves "*if possible*." While it may be possible to capture certain individuals, given the size and fluidity of the red wolf population 11 years after initial reintroductions, it is not possible to recapture, remove, and keep these wolves off of a tract of land. Because the current red wolf rule requires the release of non-problem wolves as soon as possible, the removed wolves, or other wolves, will often reoccupy the land in question. Also, the more a wolf is trapped the more trap-wary that wolf becomes. Thus, in some cases it may not be possible to capture certain individuals. Furthermore, removal of non-problem wolves may be contributing to the establishment of coyotes in north eastern NC and thus such removals may have a detrimental effect on red wolf recovery efforts by increasing the threat of hybridization.

RED WOLF REGULATIONS

Problems encountered or anticipated in implementing our current red wolf regulations, as articulated in a memo of December 1, 1998, from Brian Kelly to Gary Henry support a need to revisit the regulations. This paper was intended to provide input to participants that will evaluate these regulations in a meeting planned for January 21, 1999 in Manteo, North Carolina and has been revised in incorporate the results of that meeting.

Although other regulations were briefly discussed at the planned meeting, this paper will concentrate only on the regulations (two in number) that have been identified as potential problems. These regulations are as follows (50CFR, Part 17.84):

"(c)(4)(v) Any private landowner may take red wolves found on his or her property . . . after efforts by project personnel to capture such animals have been abandoned, *Provided* that the Service project leader or biologist has approved such actions in writing and all such taking shall be reported within 24 hours . . ."

"(10) . . . Any animal . . . that moves onto lands where the landowner requests their removal will be recaptured, if possible, . . . Such animals will be released back into the wild as soon as possible, . . ."

Background

The original 1986 rule stated in 17.84(c)(10) that "Any animal . . . which moves off Federal lands, will be immediately recaptured . . . Such an animal will be released back to the wild on the refuge as soon as possible, . . ." In the Supplementary Information provided in the 1995 rule change under the section entitled "Special Rule Changes for Both Reintroductions" it is stated " The intent of the special rule regarding the recapture of wolves leaving Federal lands was that it would be implemented only when such wolves caused conflicts and/or the landowner wanted the wolves removed. This intent is not clear. Red wolves had established themselves on private lands within 2 years (1989) of the first reintroduction releases, and several private landowners have agreed to allow the wolves to inhabit their property. Obviously, there is no need to remove wolves from private lands when the landowner has no problem with the wolves being there. Therefore, the special rule is modified to provide that all landowner requests to remove wolves from their property will be honored, but wolves that inhabit lands where the landowner agrees to allow them to reside will not be recaptured unless they cause a conflict."

In addition, Gary Henry addressed perceptions regarding Service commitments regarding wolves on private lands in a June 2, 1995 letter to Tom Ellis, Chairman of the Nongame Wildlife Advisory Committee of the North Carolina Wildlife Resources Commission as follows:

> I need to address comments concerning the original Service proposal for Alligator River. Since I was not involved with the project at that time, I cannot attest to any statements--made or not made . . . The only documentation I can find regarding the proposal are the proposed and final rule and the EA. I have found nothing in these documents stating that (1) wolves wandering off the refuge could be shot,

(2) wolves being killed off the refuge would be addressed under state jurisdiction, and (3) there was an agreement the Service had supposedly violated. It seems reasonable to me that if these were important issues regarding oral commitments, the reviewing agencies (such as the North Carolina Department of Agriculture and the Commission) would have addressed them when they reviewed the documents. No such comments were received.

I assume the statement in the final rule that wolves moving off Federal land would be recaptured could be interpreted as an agreement to confine the animals to the refuge and a failure to do so would violate such an agreement. Again, I am at a disadvantage because I was not involved at that time. However, my discussions with personnel involved and other evidence leads me to other interpretations. I think the assumption was made that the wolves, by and large, were not wanted on private land so most of them would need to be recaptured. I do not believe that the intent was to recapture animals on private land where the landowners accepted their presence. This belief is based on several pieces of evidence, in addition to conversations with the personnel involved. First of all, reintroduction began in 1987, and in that same year the first private landowner agreement was signed" (incorrect - this was an oral agreement) "to allow wolves on private property. By 1989, and ever since, wolves have inhabited private property. By the end of the 5-year experimental phase of the project in 1992, wolves inhabited private land adjacent to Pocosin Lakes, and the owners of a total of 187,000 acres of private land had agreed to allow wolves on their property.

Other indirect pieces of evidence that the intent was not to confine wolves to the refuge would include the biological fact that there is no way to confine a wild animal like a wolf, an animal that is known for extensive travel and large home ranges, to a small refuge the size of Alligator River. By definition, if they could be and were confined to a specific area like the refuge, they would no longer be " wild" animals. Also the experimental population boundary established for the reintroduction included four counties (later extended to five counties) in their entirety.

Supplementary Information provided in the 1995 rule change regarding intent included the following:

In the section entitled "Special Rule Changes for Both Populations" is found:

It is highly objectionable to owners of livestock and pets to be unable to kill a predator that is engaged in killing their livestock or pets. This, in turn, leads to the erosion of public support for predator reintroductions, which is essential if this effort is to be successful. Also, there may be a time lapse before offending animals settle into a predictable pattern whereby they can be recaptured. During this time period, private landowners will not be allowed to take the animals themselves. The Service will respond to reported incidents within 48 hours. However, the existing special rule (Part 17.24(c)(4)(iv)) does not establish a

definitive time when Service or State attempts to recapture the animal are deemed unsuccessful and the private landowner is then permitted to take the offending animals. This is a decision that must be made by the Service project leader or biologist in the field at the depredation location. Therefore, a rule revision provides that private landowners will be permitted to take offending animals upon written approval by the Service project leader or biologist on site of the depredation. This approval will be provided when the Service abandons attempts to capture the offending animal and will specify the authorized personnel (landowner and a limited number of his agents), the number of animals, and the time period (not to exceed 6 months). Also, private landowners will be allowed to take red wolves in the act of killing livestock or pets on private lands without the need for Service approval.

Experience at Alligator River and the Park indicate a need to extend the harassment and take provisions now in place for private livestock owners to include all private landowners. Wolves that come in close proximity to private residences may cause property damage by killing pets or removing and/or physically defacing small property items. In addition, private individuals may not want the animals on their property because they fear them or consider them a nuisance. Although currently not covered by such rule provisions, these stipulations have been implemented as reasonable law enforcement procedures. . . . The special rule is revised to provide the legal basis for a provision now being implemented as a reasonable procedure.

In the section entitled " Summary of Comments and Recommendations" the *Service Response* to *Issue 5* includes:

The Service has revised the provision to allow private landowners to harass wolves in an opportunistic manner at any time on their property and to take such animals with Service approval if the Service's attempts to take the animals are unsuccessful. Notification would allow the Service to remove the offending animals, which are still valuable to the recovery objectives as breeding animals. If unsuccessful in removing the animals, the Service will permit the landowner to take action to remove any returning animals. The provision has also been revised to make it clear that the Service project leader or biologist on site of the depredation will provide approval to the private landowner and has indicated in the previous sections explaining the rule changes that such approval will be provided when the Service abandons attempts to capture the offending animal. A definite time period for such approval cannot be provided because of the variation in individual wolf behavior; e.g., one wolf may stay in the vicinity or return daily, while others may not return for days. The Service also adopts the 48-hour Service response time to reported incidents, as recommended and indicated in the previous sections explaining the rule changes. . . .

While the position of the Society regarding responsibility of private citizens to protect pets and property is reasonable with regard to naturally occurring wildlife

species, programs to purposely reintroduce predators, such as the red wolf, must be accompanied by provisions to protect private property from the presence of such reintroduced animals if the landowner does not want them on his property. Such protection is necessary in order to obtain local public support, which is essential to success. Without such support, reintroductions are doomed, because the animals can be efficiently eliminated, as evidenced by past history.

This background explains the reasons for the regulations in their present form, i.e., the perception, right or wrong, that the Service committed to keeping wolves off of private lands, at least where they were not wanted, coupled with recognition that eventually removing wolves from private lands would be unworkable in terms of manpower extended to affect removal. The approval letter was considered an option to be implemented when we did not want to expend manpower in removing wolves. It was felt that we would only authorize the taking of a number of animals for which we had evidence that were using the property and only for a specified time period. Based on historical evidence, it was believed that the possibility of landowners taking wolves using legal lethal means (primarily shooting) was very low. Wolves were only historically extirpated by an all-out intensive predator control program using traps, poisons, den digging, etc. The most likely method for landowner success in taking wolves would be by employing local trappers. We could include in an approval letter that wolves taken alive must be returned to the Service. Over time, it was considered likely that the landowner would eventually see the folly in removal attempts and would learn to live with the animals.

Other information also needs to be considered. Wildlife are not the property of landowners but belong to the public and are managed by Federal and State governments for the public good. As a result of this public ownership, traditional wildlife management concepts do not provide for the taking or removal of wildlife from private lands in the absence of a problem. However, the reintroductions of endangered species, particularly predators, is viewed differently by the public because they do not consider them as naturally occurring populations but as artificially constructed populations forced upon them by the government. Because of this viewpoint and the prohibitions against taking of endangered species the public did not support reintroductions of endangered species until the ESA was amended to provide for experimental population designations and the attendant flexibility to reduce taking prohibitions by writing regulations to address local situations. In comparison to other wolf reintroductions, the two regulations under scrutiny are not used in the Rocky Mountain reintroduction projects, but the regulation to remove wolves from private land where they are not wanted is used in the Mexican Wolf reintroductions.

Present Situation

Brian Kelly's December 1, 1998 memo to Gary Henry and the attached November 23, 1998 memo from Brian to his field crew (attached) provides input regarding the present situation and articulates the frustration in dealing with the situation and some potential risks involved with implementing the regulations. The only things to be added are (1) the fact that the public perception by some that we committed to keep wolves off of private lands, at least where they were not wanted, is still common and (2) we have never implemented approval letters so we have no evidence to support or refute the usefulness of this regulation.

Alternatives

The alternatives revolve around the flexibility present in the current regulations, the question of changing or not changing the regulations, and the timing of suggested changes. These alternatives are as follows:

No Change: Fully implement the existing regulations, including the letter to landowners to take wolves.

> **Benefits:** By not changing the regulations current support for the project will not be altered. A spinoff of this is that we continue our past philosophy of not stirring the pot when things are going well, thus minimizing possibility of adverse political consequences.
> **Liabilities:** By implementing regulations that are not in line with traditional wildlife management concepts, that are probably the most lenient regulations for taking of any endangered species, and that are not in agreement with other wolf reintroduction projects, protectionist groups may not support the project. (Note: We were threatened with a law suite that never materialized on these regulations. Thus, the danger of challenge to the regulations has likely passed.) If significant number of landowners request and receive approval letters and are successful in taking wolves, we may be compromising our ability to manage and recover the species (see Brian Kelley"s November 23 and December 1, 1998 memos),

Change Regulations ASAP: Amend the regulations to only allow the taking or removal of animals that have caused a problem.

> **Benefits:** This would bring the regulations into closer agreement with traditional wildlife management concepts and would enhance our ability to manage and recover the species.
>
> **Liabilities:** This would risk a public backlash that could erode local support for the project and could result in political consequences (Note: Remember that Senator Helms came within one vote of eliminating funding for this project a few years ago).

Change Regulations When We Submit Rules For the Next Reintroduction Project: We most likely will be submitting a proposed and final rule to implement reintroduction at a new site within two years. The proposed changes could be incorporated into such a package.

> **Benefits:** In addition to the benefits listed above, chances of public acceptance would be better if done in this way because the proposed changes would be less likely to be the primary focus because of the dilution affect due to the content of the rest of the package.
> **Liabilities:** The liabilities listed above would still be present but less likely. In addition, the delay in changing the regulations risks negative impacts to our ability to manage and recover the species during this time and this impact may have long-term significance.

Implement a Written Policy to not Remove Wolves or Issue Letters in Absence of a Problem: This would entail approval and delegation of the policy from higher administrative

levels coupled with efforts to revise the regulations accordingly, most likely in conjunction with regulations for the next reintroduction area.

Benefits: In addition to the benefits listed above, this alternative offers quicker response to the field dilemma regarding the problem. It also removes the speculation about public response by forcing public action before we respond. If legal action is threatened or implemented, efforts underway to revise the regulations would likely result in putting such actions on hold.

Liabilities: The liabilities listed in the second alternative would still be present but less likely. In addition legal action may be threatened and/or implemented.

Implement an Unwritten Policy to not Remove Wolves or Issue Letters in Absence of a Problem: This seems to be within the flexibility provided in interpretation of the current regulations. It would be explained on a case-by-case basis to private landowners by field personnel.

Benefits: In addition to the benefits listed above, this alternative offers immediate response to the field dilemma regarding the problem.

Liabilities: Same as above.

The task before us was to evaluate the relative benefits and liabilities associated with the alternatives presented, or other alternatives, and select the alternative that is judged to be in the best interests of the red wolf recovery program. The last alternative was selected for implementation.

Red Wolf in Northeastern North Carolina

ISSUE: What are the status and significant issues regarding the red wolf reintroduction into northeastern North Carolina?

Response/FWS Position:

- Red wolves were declared extinct in the wild in 1980, and were reintroduced to northeastern North Carolina (NENC) in 1987. Currently, approximately 75 red wolves inhabit a patchwork of approximately 1 million acres of federal, state and private land in 5 NENC counties. It is considered a landmark program in species conservation that laid the groundwork for other Endangered predator reintroduction programs, and is the first successful reintroduction of a species declared extinct in the wild.

- On December 21, 1998, the U.S. District Court for the eastern district of North Carolina denied the Plaintiffs' Motion for Summary Judgement in a lawsuit seeking to invalidate the federal regulations regarding red wolves on private lands. A North Carolina state law passed in 1994 that allowed landowners to trap and kill red wolves was nullified by this ruling.

- A meeting of Service and Solicitor Office personnel regarding the current red wolf regulations concluded with a consensus that interpretation of the current regulations provides the flexibility to deny requests for removing wolves from private lands in the absence of a problem. This interpretation of the regulations is also in tune with traditional wildlife management concepts and laws. Wildlife are not the property of landowners but belong to the public and are managed by Federal and State governments for the public good. Such concepts and laws do not provide for taking or removal of wildlife from private lands in the absence of a problem.

- The Service, under the authorities of Endangered Species Act, is committed to recovering the red wolf in a biologically sound, publicly acceptable, and fiscally responsible, manner. The reintroduction efforts in northeastern North Carolina have demonstrated that recovery is possible with little or no significant impacts to local residents. All involved programs within the Service were party to the decision made on interpretation and implementation of the current regulations. We will consider revision of the regulations in conjunction with regulations to be promulgated for the next reintroduction site within two years. Although most local residents have little or no contact with red wolves and/or have learned to live with them, a few private landowners may disagree with our interpretation of the regulations and threaten or implement measures to legally or politically challenge the Service.

Background Information:

- Continuous requests from two to three private landowners to remove red wolves from their property have created a workload burden for project staff. Additional private landowners may also make such requests in the future. As more than 50% of the lands inhabited by wolves is privately owned, such requests could be substantial. Removal of wolves not causing a problem may also be detrimental to conservation and recovery of the species. This situation led to a recent (January 21, 1999) meeting regarding interpretation and implementation of our regulations. Until now, we have attempted to honor all requests to remove wolves from private lands, whether a problem existed or not. Our practice of trying to honor all requests for wolf removal has been a major drain on project staff. It is now clear that with a population of wolves estimated at 75 or more, and given their tendency to travel long distances, their territoriality, the mixture of land ownerships, and the cost in manpower and funds that would be better used to promote recovery, it is not possible to recapture, remove, and keep wolves off of a specific tract of land. In addition, removal of wolves in the absence of a problem may be detrimental to the conservation of the species by preventing natural expansion and recovery of the species, and by contributing to the establishment of coyotes. This may result in interbreeding between the two species. Interbreeding with coyotes was the final factor that led to endangerment and near extinction of the species.

- In cooperation with the Regional Solicitor's Office, we have developed written guidelines for implementing the regulations. These guidelines address the removal of wolves that (1) are causing a problem and (2) are not causing a problem. A problem is define
d in the guidelines and justification spelled out for the guidelines applied in each category. Requests to remove wolves will be evaluated on an case by case basis and a decision on removal made based on established criteria.

Contact: Gerry A. Jackson, Assistant Director, Ecological Services (202/208-4646)

Date: February 23, 1999

Expert Report of John A. Vucetich

Red Wolf Coalition, et al. v. USFWS, et al.
NO. 2:15-cv-00042-BO

July 31, 2017

Signature

Table of Contents

1. Scope

I have been asked by Southern Environmental Law Center to evaluate the effects of *changes in red wolf management* that the U. S. Fish and Wildlife Service (FWS) has implemented. These changes include: (i) removal (lethal and non-lethal) of wolves by the FWS from the wild population at the request of landowners when there is no reasonable evidence of their having been a threat to human safety, (ii) cessation of management that had been effectively limiting hybridization between red wolves and coyotes (hereafter, 'cessation of adaptive management' for short), and (iii) cessation of wolf introductions from the captive population to the wild population.

These changes greatly increase the risk of extinction to the wild population of red wolves. They have been a significant setback in the effort to recover red wolves and have resulted in harms that would not be easily undone. These changes in management do not appear to serve the goal of recovery of the red wolf, including the 1990 recovery plan's stated objective of "approximately 220" red wolves in the wild.

The conclusion described in the previous paragraph is developed throughout the main portion of this document which is organized as a series of expert opinions, each of which is demonstrated in its own section:

#1: The wild population of red wolves is at critical risk of extinction.

#2: Cessation of adaptive management works against red wolf recovery.

#3: Lethal removal of red wolves, as implemented by the FWS, works against red wolf recovery.

#4: Non-lethal removal of red wolves, *as implemented by the FWS*, *works against red wolf recovery.*

#5: Cessation of wolf introductions to the wild population from the captive population does not contribute to red wolf recovery.

#6: Inadequate strategic planning is a critical threat to red wolf recovery.

Expert opinion #1 establishes the need to exercise great care and urgency in efforts to recover red wolves. Expert opinions #2, #3, #4, and #5, collectively indicate why the new FWS changes in management exacerbate an already dire situation for the wild population of red wolves. Expert opinion #6 demonstrates that FWS must realign its red wolf management with the requirements of the Endangered Species Act to plan for the recovery of the species.

Statement of Compensation: I will be compensated by the Southern Environmental Law Center at a rate of $65 per hour for my involvement in this case.

2. Qualifications of the author

I am a professor of wildlife conservation at Michigan Technological University, where I teach courses in population biology and natural resource ethics. I have authored or co-authored more than 100 scientific articles, book chapters, and formal reports. Collectively, they have been cited in the scientific literature more than 2,000 times. I served as Subject Editor for *Oikos,* a high ranking journal of ecology, handling 91 papers between 2006 and 2010. Most of my scholarship is on two topics, wolf ecology and the human dimensions of natural resource management. Appendix A contains a list of publications I have authored in the past ten years.

According to the Web of Science of the Institute for Scientific Information, I am the third most productive and cited scholar in the world with respect to the ecology of wolves for the period 1997-present (the period of time covering my professional career).

I have been studying wolves for 20 years, mostly in the capacity as leader of wolf-moose research on Isle Royale National Park. That project is the longest study of any predator prey system in the world, is known by animal ecologists throughout the world, and is a frequent component of curricular materials for students in secondary and higher education. In 2008, Senator Carl Levin (MI-retired) expressed gratitude for my contributions to this project with a formal statement entered into the Congressional record. I have also been a long-term contributor to wolf research in Yellowstone National Park. My contributions to wolf scholarship also include wolves from Banff National Park (Canada), Algonquin, Upper Michigan, and Sweden.

The research that I have conducted on wolves includes a wide variety of research methods – including genetic techniques; population and statistical modeling; estimating population abundance and vital rates, such as mortality, recruitment and kill rates; behavioral observations; and habitat assessment. I have applied those and other methods to contribute insight to the scholarly literature on topics pertaining, for example, to the social structure of wolves, the impact of wolves on prey populations, extinction risk in small populations of wolves, impact of genetic rescue on the genetic and demographic health of small wolf populations. Additionally, I have conducted research on the extinction risk of small populations, including wolf populations. This work has explored how much more at risk a population is as it declines in numbers.

I have also contributed to the scholarly literature on the human dimensions of natural resource management. Of particular relevance are scholarly assessments of (*i*) the relationship

between carnivore conservation and human intolerance of carnivores (e.g., Bruskotter et al. 2014), (*ii*) the use (and misuse) of science in development of strategies for managing wolves (Vucetich et al. 2017), and (iii) broad strategies in conservation (e.g., Vucetich et al. 2017b). Ideas associated with those research endeavors are employed in portions of this expert report. This work on the human dimensions of natural resource management is generally conducted in collaboration with Professor Jeremy Bruskotter, an expert in the social and behavioral science of humans from Ohio State University.

I have served as a witness before a subcommittee of the U.S. House of Representatives (Oct 2016) and a committee of the U.S. Senate (July 2017) in hearings related to the federal management of wolf conservation. I have served the FWS as a member of the Mexican wolf recovery team since 2001. I also was a formal reviewer of the revised Wyoming state plan for managing wolves. I represented scientific knowledge of wolves on behalf of the Little River Band of Ottawa Indians in consultations that took place with the state government of Michigan in the context of a consent decree between the tribe and the state. In 2006-07, I also served the state of Michigan at their request on the Michigan Wolf Steward's Roundtable, where my responsibility was to represent scholarly knowledge of wolf management. Finally, I have been a member of the Canid Specialist Group of the Species Survival Commission of International Union for the Conservation of Nature (IUCN) since 2014.

3. Background

Red wolves have been of conservation concern for decades. By 1980, red wolves were extinct in the wild. In 1987, red wolves were reintroduced to the wild in northeast North Carolina in what is known as the Red Wolf Non-Essential Experimental Population Area (RWEPA). The

RWEPA was previously comprised of three management zones, characterized by the intensity of management within each zone. The wild population is managed as a non-essential, experimental population, under the ESA.

The number of red wolves in this wild population steadily increased from 1987 to 2002, by which time the wild population reached approximately 130 wolves. Population abundance remained approximately stable (at approximately 120 wolves) for the period 2002-2011. Some wolf biologists have indicated that this number of wolves (120) may be near the maximum that can be supported within the RWEPA (2,600 sq. miles) (USFWS 2007). Since that time the population has declined alarmingly. By 2015, the population was reduced to approximately 50 wolves and comprised of eight or fewer breeding pairs. The most recent information (from December 2016) indicates that there are only 22 known red wolves in the wild and the estimated total abundance is between 25 and 48 wolves (USFWS 2016d). Other recent information indicates that the population is comprised of just 3 known breeding pairs as of September 2016 (USFWS 2016a).

Red wolves also exist in a captive population comprised of approximately 210 animals. The captive population is critical for protecting the genetic viability of red wolves. The captive population is also the source for reintroducing new wolves into the wild.

The taxonomic status of red wolves has been a long-standing concern and has been debated by scientists for decades. The scientists associated with this debate have also indicated their belief that any of the likely hypotheses for the taxonomic status of red wolves would also lead to the conclusion that red wolves are a listable entity (USFWS 2016a). The FWS has also indicated that it believes the red wolf is a listable entity and that pursuit of its recovery under the ESA is appropriate (USFWS 2016a).

4. Expert Opinions

4.1. Expert Opinion #1: The wild population of red wolves is at critical risk of extinction.

The FWS estimates that the wild population of wolves declined from approximately 100 to approximately 50 wolves during a two-year period between 2013 and 2015 (USFWS 2016b). The FWS also estimated that the population is comprised, as of 2015, of eight or fewer breeding pairs. I am aware of more recent estimates of only 22 known wolves, for a population size of 25-48, and only 3 breeding pairs. Such a decline is catastrophic and indicates the wild population is in extreme danger of extinction.

The FWS recently convened a team of experts to conduct an analysis of extinction risk for the red wolf population. That team concluded (Faust et al. 2016a): "Current conditions…will result in extinction of the only remaining wild population of red wolves, typically within 37 years but in some iterations as soon as 8 years. Extinction will likely occur earlier than this timeframe because the population has already declined to lower than the model starting point." I reviewed Faust et al. (2016a) with this conclusion in mind and have no reason to doubt that conclusion.

The dire nature of these circumstances is indicated, in part, by the categories of extinction risk established by the IUCN. The IUCN distinguishes five levels of extinction risk. According to this classification scheme, red wolves qualify as "critically endangered" referring to the most severe class, meaning that they have an "extremely high risk of extinction in the wild."

When a population is as small as the wild population of red wolves, the loss (by death or removal) of just one wolf can have a significant adverse impact on the population. This is mainly because a single wolf represents a relatively large percentage of the population when the population is small. The social structure of wolves compounds this concern. Only a portion of

wolves in a population are breeders. In the case of red wolves – which is likely comprised of only three breeding pairs – the loss of a single breeding pair would represent an especially significant loss in the percentage of breeders. The loss of a single wolf in a population as small as the current red wolf population could have lasting impacts on the population and impair the ability of the population to recover.

4.2. Expert opinion #2: Cessation of adaptive management works against red wolf recovery.

Red wolves and coyotes can produce hybrid offspring. If hybrid reproduction occurs too frequently, then red wolves can be driven to extinction by the red wolf genome, essentially, dissolving or dissipating into the coyote genome. Hybridization between red wolves and coyotes has been recognized as a threat to red wolves for quite some time (e.g., Paradiso and Nowak 1972).

In response to this critical threat, the FWS developed an adaptive management program whose implementation began in the late 1990s (Stoskopf et al. 2005; Gese et al. 2015). This program included, among other strategies, sterilizing and euthanizing coyotes in order to reduce hybridization between wild red wolves and coyotes. Sterilized coyotes cannot mate with red wolves, and they also hold territories in ways that exclude other non-sterilized coyotes from entering red wolf core areas and hybridizing.

Over the past few years, about half a dozen scientific papers focused on evaluating the efficacy of the adaptive management program (e.g., Murray et al. 2015, Bohling & Waits 2015, Gese et al. 2015, Gese & Terletzky 2015, Bohling et al. 2016). These papers vary somewhat in focus and highlight different findings. For example:

+ **Murray et al. (2015)** compared demography (survival, recruitment) and cause of death of red wolves and coyotes/hybrids and concluded "*while [adaptive management] is successful insofar as providing red wolves with conditions allowing them to survive and produce young, such conditions likely are insufficient to give wolves the demographic advantage that will promote establishment of a self-sustaining population in the absence of intervention.*"

+ **Gese et al. (2015)** evaluated the adaptive management program by assessing *"(1) the numbers of wolves, coyotes, and hybrids captured, (2) the numbers of territorial social groups with presumed breeding capabilities, (3) the number of red wolf and hybrid litters documented each year and (4) the degree of coyote introgression into the wild red wolf gene pool*" for the period 1993-2013. They found "*substantial increases in the number of known red wolves and red wolf social groups from 1987–2004 followed by a plateau and slight decline by 2013. The number of red wolf litters exceeded hybrid litters each year and the proportion of hybrid litters per year averaged 21%. The genetic composition of the wild red wolf population is estimated to include < 4% coyote ancestry from recent introgression since reintroduction.*" Finally, they concluded: "*that the adaptive management plan was effective at reducing the introgression of coyote genes into the red wolf population, but population recovery of red wolves will require continuation of the current management plan, or alternative approaches, for the foreseeable future*."

+ **Bohling & Waits (2015)** studied the circumstances that surround wolf-wolf reproductive events and wolf-coyote hybridization events. They found that hybridization events were often preceded by human-caused mortality where one of the wolves in a mated pair was killed prior to breeding. They concluded *"for the adaptive management plan to be*

successful, more effort must be placed in reducing the number of red wolves killed by gunshot to facilitate efforts to restrict hybridization."

+ **Bohling et al. (2016)** analyzed the genetics of canids in a region where hybridization is most likely to occur.[1] They found "*Hybrids composed only 4% of individuals within this landscape despite co-occurrence of the two species… The low proportion of hybrids suggests that a combination of active management and natural isolating mechanisms may be limiting intermixing within this hybrid system*." They conclude that adaptive management "*has been successful in limiting hybridization and preventing genetic swamping. Noninvasive genetic surveys and active trapping within the RWEPA suggest a dominance of red wolf genotypes with isolated instances of hybridization (Adams et al. 2003, 2007; Gese et al. 2015). Tracking reproductive events through a reconstructed pedigree has revealed only one hybridization event, the initial litter from 1993, resulted in the introgression of coyote DNA into the red wolf population (Adams 2006; Bohling et al. 2013). There have been substantially more documented red wolf litters than hybrid litters (Bohling and Waits 2015; Gese et al. 2015)*."

+ **Gese & Terletzky (2015)** evaluated a basic element of the adaptive management program. In particular, they evaluated the notion that the rate of hybridization can be effectively limited by "placeholders." Placeholders are coyotes of wolf-coyote hybrids that are captured, sterilized, and released. The idea is that these placeholders (which cannot breed) would occupy territories (excluding fertile coyotes and hybrids) until either displaced or killed by a wolf. The authors concluded: "*Placeholders provided territories for wolves to*

[1] That region included portions of five counties (Washington, Beaufort, Martin, Edgecombe, and Pitt) in north-eastern North Carolina that compose or are adjacent to the RWEPA.

colonize, yet reduced the production of hybrid litters, thereby limiting genetic introgression to <4% coyote ancestry in the wolf population."

The preceding summary of the scientific literature focused on highlighting the findings and conclusions as expressed in the words of the authors of those papers. I reviewed these papers and have no reason to doubt their findings or conclusions. Collectively, the research represented in these papers indicate *that full continuance of the adaptive management program, including sterilizing coyotes, is a necessary but insufficient condition for persistence of the red wolf population. The FWS adaptive management program had been effective at limiting hybridization to a reasonably low level.* While I did not summarize, here in this document, every scientific paper that addressed this topic, I am unaware of any paper that gives a different impression than what is presented here.

My understanding is that FWS ceased implementation of the adaptive management program in 2013 or 2014. The only public explanation offered for why the FWS thinks the cessation is justified appears to be based on an understanding of adaptive management's efficacy that is subtly though substantively at odds with the scientific literature (USFWS 2016a):

> *…the challenges of controlling hybridization are strong. For example Gese et al. (2015) has concluded that the success of the red wolf adaptive management program at controlling hybridization was mixed [emphasis added].*

This statement is very likely a misinterpretation of Gese et al. (2015). Gese et al. (2015) wrote: "The success of [adaptive management] at controlling hybridization and facilitating red wolf recovery was mixed, based [on] our criteria. The number of red wolves did increase over time but plateaued [to about 120 wolves] around 2009 and declined slightly thereafter." My understanding of Gese et al. is that they conclude adaptive management was not successful *in the*

narrow sense that red wolf abundance did not increase beyond 120 wolves in response to the implementation of adaptive management. That lack of increase is likely attributable – not to failures in limiting hybridization – but to high rates of mortality and habitat saturation (i.e., the recovery area is likely not large enough to support a larger population). Gese et al. concluded that adaptive management was successful at limiting hybridization. They write: "We conclude that the adaptive management plan was effective at reducing the introgression of coyote genes into the red wolf population, but population recovery of red wolves will require continuation of the current management plan, or alternative approaches, for the foreseeable future."

The same FWS document, quoted above, suggests that research showed that the adaptive management program had not been effective (USFWS 2016a):

> *Although the [adaptive management program] has managed to keep hybrids to 4% of the known wild red wolf population, the number of coyote-wolf hybrids detected over time did not decrease and the ratio of hybrids to pure red wolf litters did not decline either.*

Again, this is an inappropriate representation of scientific knowledge about the efficacy of the FWS's adaptive management program. The appropriate reading of this knowledge is: Even though the number of coyote-wolf hybrids detected over time did not decrease and the ratio of hybrids to pure red wolf litters did not decline either, the adaptive management program has managed to limit hybrids to <4%. In other words, the adaptive management program was successful in its goal of preventing an increase in hybridization events within the wild red wolf population.

In summary, USFWS (2016a) seems to be: (i) an attempt to justify the FWS's cessation of the adaptive management program, and (ii) based on a fundamental misreading of the scientific literature.

Based on my review of relevant materials, it appears that if the FWS's adaptive management practices are not resumed, the wild population of red wolves will almost certainly go extinct. The best chance for recovery of the species includes undertaking adaptive management practices, including sterilizing coyotes as was previously done by the FWS.

4.3. Expert Opinion #3: Lethal removal of red wolves, as implemented by the FWS, works against red wolf recovery.

Human-caused mortality is the leading cause of death for red wolves in the wild, accounting for an estimated 73% of all red wolf deaths (Hinton et al. 2017; see also USFWS 2016b). Half of these human-caused mortalities are attributable to foul play or suspected foul play. The Service's recent decision to issue lethal take authorizations to private landowners contributes to human-caused mortalities and will have significant impacts on the red wolf population.

The high proportion of deaths due to human causes is important because growth rate of the red wolf population is adversely impacted by increased rates of overall mortality and increasing rates of human-caused mortality (Sparkman et al. 2011). Furthermore, the portion of deaths caused by humans has been steadily increasing gradually over the past two-and-a-half decades, and the portion of deaths caused by gunshot has also been steadily increasing over the same time period (Hinton et al. 2017). Human-caused mortality is important not only as a direct threat, but also because it exacerbates the threat associated with hybridization (Bohling and

Waits 2015). In particular, when a red wolf breeder is lost just before or during the breeding season, hybridization with coyotes often occurs before new red wolf pairs can form and before incoming coyotes can be captured and sterilized (Bohling & Waits 2015).This latter concern arises because the death of a wolf is followed too often by that dead wolf's reproductive mate finding and subsequently mating with a coyote or wolf-coyote hybrid.

Allowing lethal take of red wolves on private land, when the wolf has not presented any threat to human safety or property, is likely to impair red wolf recovery. This change in management can result in the death of biologically important breeding red wolves, and can exacerbate hybridization with coyotes. The FWS's practice of issuing lethal take permits to private landowners for non-problem wolves works against red wolf recovery.

4.4 Expert Opinion #4: Non-lethal removal of red wolves, as implemented by the FWS, works against red wolf recovery.

Removal of wolves from the wild by the FWS – through lethal or nonlethal methods – has essentially the same consequence on the wild population as when wolves are removed by being otherwise killed. In particular, when the population is small (as it is) each individual wolf represents a relatively large proportion of the population (see previous section). For example, if the wild population is comprised of just 45 wolves, then removing, for example, just 3 wolves in a year represents a 7% loss. That loss would be in addition to the other sources of mortality occurring in a year. While a much larger population might be able to withstand such a practice and still grow, the current population of red wolves cannot.

The detriment of removing wolves from the wild includes impacts to (i) the removed animal, which is not available to contribute to the wild population and is likely to suffer stress

and become habituated while in captivity, and (ii) the pack or mate left on the landscape, which may hybridize with coyotes. The specific effect of removal will depend on which animals are removed. For example, if the wolf in question is a socially important animal, such as a breeder or potential future breeder, then removal of that animal can have a particularly detrimental impact on the red wolf population's viability. From a practical, population management perspective, such removals are functionally equivalent to mortalities and are reasonably counted as such in terms of their population impact.

A similar management approach was being undertaken with Mexican wolves and the scientific panel reviewing the program recommended that it be discontinued because it was impairing recovery of the species (Paquet et al. 2001).

Even if the wolf is subsequently released elsewhere at a later date, the effect is very likely adverse. In particular, when such wolves end up being not in their own territory and in an unfamiliar area, they are subsequently disadvantaged with respect to capturing prey, avoiding conflicts with humans, and avoiding competition. Those conditions can also impair a newly released wolf from becoming a breeding wolf. The effect of removing wolves from private lands and releasing them elsewhere at a later date is very likely to have a particularly damaging effect on the red wolf population given its current size. The removal of red wolves at the request of landowners would likely lead to the removal of too many wolves from private land. Public lands on the Albemarle peninsula of North Carolina are enough to support only a small fraction of the wolves required by the recovery goal of approximately 220 wolves (USFWS 1990).

Finally, and as mentioned above, the efficacy of adaptive management is hindered by high rates of removal, which include lethal and non-lethal removals by FWS. The concern is that the new elements of the FWS's new approach to red wolf management does not merely include

two detrimental elements (removals and cessation of adaptive management). Those two elements of that approach work synergistically to further exacerbate the overall threat to red wolves.

4.5. Expert Opinion #5: Cessation of wolf introductions to the wild population from the captive population does not contribute to red wolf recovery.

In June 2015, the FWS announced that it was ending its practice of introducing red wolves to the wild population from the captive population, including the release of wolf pups to be fostered in the wild. This change in red wolf management is very likely to have significant negative impacts on the wild population, especially given its small size. Recent scientific analyses underscore the importance of releasing captive wolves into the wild red wolf population.

In June 2016 the Red Wolf PVA Team submitted a report to the FWS at their request (i.e., Faust et al. 2016a). The report performed a wide range of computer simulations that project the future condition of the population, given various conditions. These simulations, known as population viability analyses (PVAs) – are essentially "if-then" statements: If a population is characterized by these properties (e.g., mortality rate of *W*, birth rate of *X*, etc.), then the population would have a *Y* percent chance of going extinct over *Z* years. The PVA team analyzed more than two dozen such scenarios. PVAs are useful for judging the relative merits of various possible conservation strategies and in some cases are useful for making absolute estimates of extinction risk.[2] Two scenarios – the baseline and scenario FF – were designed to understand extinction risk if the population's condition remains as it is today (under current management).

[2] The relative merit of two conservation scenarios can be judged by estimating the population's demographic properties (mortality, reproduction, etc.) under two different scenarios and then comparing the *relative* extinction risk of the simulated populations. In some cases – i.e., when the species is very well studied and when the time horizon is relatively short – PVAs are also useful for estimating *absolute* risk of extinction.

Those scenarios – baseline and FF – indicate that the captive population has a very low risk of extinction. Those scenarios – along with scenario Z – also indicate that the wild population is at grave risk of imminent extinction.

Other scenarios indicated that resuming releases of captive-born red wolves into the wild population could substantially reduce the wild population's risk of extinction. In particular, the PVA team performed analyses of approximately a dozen different scenarios aimed at better understanding the importance of introducing wolves from the captive population into the wild population. These analyses indicate: (i) introductions are very important to persistence in the wild at this time, and (ii) it is feasible to implement a strategy for introductions that would result in much safer levels of extinction risk.

In September 2016 the FWS wrote: "the species [red wolf] is not secured in captivity" (USFWS 2016a) and that "with no changes to current management, the species will likely be lost within the next decade." (USFWS 2016c). The basis for these claims – according to the FWS – is Faust et al. (2016a), the PVA report. These claims also appear to have been an important part of the rationale for the FWS concluding that limited resources available to the red wolf program should be re-allocated from the wild population to the captive population.

In October 2016, the PVA team delivered a memo (i.e., Faust et al. 2016b) to the FWS detailing how those aforementioned FWS references to the PVA report had misinterpreted the conclusions of Faust et al. (2016a). The PVA teams states in this memo: "To clarify… the [captive population] is under no risk of extinction." The memo goes on to provide the finely detailed explanation of how the report should be read as to avoid the FWS's misinterpretation.

I do not have any elaboration, caveat, or criticism of the PVA team's conclusion that the FWS misinterpreted the original PVA report. For emphasis, it does not appear that the FWS

disagrees or has reason to disagree with the methods or conclusions of the PVA analysis. Rather, it seems that the FWS simply misread the original report.

According to a news report, the FWS defended itself on this account when the regional director reportedly stated (Hudson 2016):

> *We took several documents into consideration relative to the management actions we proposed for the captive population that we believe align with our collective recovery objective. … As we consider all of this information, we simply concluded we need a higher success rate in maintaining genetic diversity and ensuring* long-term *[emphasis added] survival of the species.*

I am concerned that there is no public account of how other documents lead to the FWS's conclusion. Such an account would seem warranted, given the FWS's changes in management are a radical departure from their prior approach and seem to represent a setback for achieving recovery.

Contrary to the FWS's misinterpretation of the PVA, the captive population of red wolves is not in imminent risk of extinction, and releasing red wolves from the captive population into the wild population is essential, at this time and given the dire circumstances, for red wolf recovery. The FWS's cessation of such reintroductions in 2015 has been detrimental to recovery of the wild red wolf population.

4.6. Expert opinion #6: Inadequate strategic planning is a critical threat.

Wildlife management is – being a kind of management – at its core a strategic endeavor that necessarily includes development of goals, justification of those goals, and strategic actions that are likely to result in realization of those goals. Important failures in wildlife management

have resulted from failures in the development of goals and strategies. I have scholarly experience evaluating this kind of failure (e.g., Vucetich et al. 2017a). The fundamental importance of strategic planning is also codified in the Endangered Species Act (Sec 4(f), pertaining to the FWS's obligation to develop recovery plans which are to include "site-specific management actions as may be necessary to achieve the plan's goal").

The FWS has a recovery plan for red wolves in which a goal is set at "approximately 220" wolves in the wild (USFWS 1990). Scientific information gained since development of that recovery plan suggests that those goals may be less than is necessary to represent recovery as required by the Endangered Species Act. Consequently, while it may be wise to revise the goal in that recovery plan on the basis of updated science, it is appropriate to take for granted that this is the goal toward which the FWS should be striving at this point in time.

Expert opinions #2, #3, #4 and #5 explain why the FWS's recent changes in management work against this goal. These concerns are reinforced by the results of Faust et al. (2016a). In particular, the baseline scenario and the FF scenario of Faust et al. (2016a) indicate that the wild population is at grave risk of imminent extinction.

One could suppose that the FWS's new strategy for recovery increases the *short-term* risk of extinction, and that such an increase is strategic in the sense that it is valuable or necessary for advancing recovery over the *long-term*. The FWS has presented no such explanation for *how* this would be the case. And because that line of thinking is counter-intuitive to the principles of wildlife conservation and the considerations presented in this document, it should not be accepted without some vetted demonstration.

If one were to develop an adequate justification – if an adequate justification is even possible – for the FWS's recent changes in managing red wolves, that justification would have to attend carefully to several issues worth highlighting here:

1) *Proper handling of ultimate and proximate goals*. Recovery of a wild population is the ultimate goal. The captive population is – for the foreseeable future – essential for realizing that ultimate goal. A strategy that treats an essential prerequisite for the ultimate goal as the ultimate goal itself would be inappropriate.
2) *Proper handling of proximate and ultimate threats*. An ultimate threat to red wolf recovery is intolerance by local citizens, special interests, and state government. Hybridization is an ultimate threat (that can be effectively managed by the adaptive management program), but it is exacerbated by intolerance. High rates of human-caused mortality and non-lethal removals are a critical threat to red wolf recovery, but those threats result from intolerance. Recent changes in red wolf management likely exacerbate the threat of intolerance. In particular, removing non-problem wolves from private land sends a signal: if intolerance is expressed with enough vigor, then the FWS will respond by removing wolves, thereby acceding and encouraging subsequent intolerant behavior.
3) It is easy to mistakenly think that allocating limited resources to a set of possible recovery actions is governed by the rules of a zero-sum game. This is often not the case. For example, improving conditions for the captive population does not necessarily compete with making substantive progress on building tolerance.

The FWS has not given sufficient, explicit attention to these issues in their public explanations of its changes in management for red wolves. In developing a strategy for red wolf recovery, I do

not see how it is possible to properly attend to those issues and arrive at the FWS's new approach for managing red wolves.

5. Conclusion

FWS's recent changes in red wolf management are not consistent with red wolf recovery. Instead, the changes in management are consistent with abandoning red wolf recovery efforts. Loss of the only wild population of red wolves would be a grave setback to red wolf recovery. Efforts to grow the population toward established recovery goals should be enacted promptly to maintain and advance the prospects for of recovery. These efforts should include (1) ending lethal and nonlethal removal of red wolves from the landscape, (2) resuming reintroductions from the captive population to the wild population to help increase the number of breeding pairs and enhance genetic diversity of the population, and (3) resuming FWS's adaptive management program, including coyote sterilization practices.

These harms to the wild population of red wolves, brought about by the FWS's recent changes in management, may not be easily undone. For example, sacrificing the wild population will result in the loss of behaviors that are important to persistence. The concern, more precisely, is that the behavioral repertoire of red wolves would be shaped too much by their experiences in captivity if the FWS continues treating the wild population as it has been.

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Appendix A

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Publications for the period 2007-2017

School of Forest Resources and Environmental Science (SFRES),
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take regulations and interpretation of 1995 rule

Harrison, Rebecca <rebecca_harrison@fws.gov> Thu, Jul 24, 2014 at 6:57 AM
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Hi All~

I hope the RD's visit to northeastern NC went well this week! We really appreciate the opportunity for our program staff to get a chance to talk with her. I'm sorry I wasn't able to be there as well. Thank you to everyone who helped facilitate her visit.

Matt has been going through our administrative record pulling files together for our latest FOIA request and items that could be potentially helpful for the review. We found some memos and letters related to take permit requests and the 1995 rule and regulations that may be helpful. I thought I'd pass a few along in case they provide additional information/context to the latest take permit requests. I apologize--the first two pages are repeated, but I can't edit them while I'm traveling. I'll pass additional copies onto the shared drive as well.

Safe travels to everyone,
Becky

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Leopoldo Miranda <leopoldo_miranda@fws.gov> Thu, Jul 24, 2014 at 5:57 PM
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So, the very last alternative on page 12 is what we have implemented since 1995, Right?

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Rebuttal Expert Report of Pete Benjamin

Red Wolf Coalition v. U.S. Fish and Wildlife Service

No. 2:15-cv-00042-BO

Pete Benjamin

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1. Scope of Rebuttal Expert Report

As a rebuttal to the report provided by Dr. John Vucetich, I offer four expert opinions in this report regarding the red wolf (*Canis rufus*) recovery program (Program) in general, and the management of the Northeastern North Carolina Non-Essential Experimental Population (NENC NEP) of the red wolf in particular. First, while the Red Wolf Recovery Program successfully overcame many threats to red wolf survival in the wild, the program was not managed consistently with important aspects of the Endangered Species Act (ESA or Act), U.S. Fish and Wildlife Service (Service or Agency) policy and governing regulations. Second, under the current regulatory framework, the Program cannot effectively manage human interactions with wolves. Third, under the current regulatory framework, the Program cannot achieve recovery of the species. Fourth, for red wolf recovery to advance the Service requires sufficient time to promulgate new regulations and formally adopt new policy, as needed.

2. Qualifications

I am an expert in policy and program implementation under the ESA. I have over 26 years of experience with the Service, all of which involved the administration of various portions of the ESA, including ESA Sections 7, 10, and 4, as well as listing, critical habitat designation, and recovery planning and implementation. Regarding red wolves, I have been responsible for overseeing the management of the NENC NEP of red wolves since December 2013, and I am the current leader of the Red Wolf Recovery Team. In this capacity I have hands on experience in managing the NENC NEP as well as the benefit of the experience of my staff and the program managers who have preceded me.

3. **Program Overview**

Recovery efforts for the red wolf began in earnest in 1973 with the passage of the ESA. By that time, the red wolf had been driven to the brink of extinction by predator eradication efforts and habitat modification throughout most of its historic range (U.S. Fish and Wildlife Service 1982). The few remaining red wolves were confined to the coastal marshes of southwestern Louisiana and southeastern Texas. This remnant population was being threatened with extinction by an impending hybrid swarm with coyotes (*Canis latrans*), which occurs when reproductive barriers between species cease to function such that a very high percentage of individuals in the population are of hybrid origin. If such conditions persist the two species can become genetically indistinguishable. Soon after recovery efforts began Curtis Carley, the first Red Wolf Recovery Coordinator, and his team realized that the initial strategy for saving the red wolf from extinction, which called for creating a buffer zone between the red wolves and the coyotes, would not work given the tools available at the time. They therefore made the bold decision to remove the remaining red wolves from the wild (USFWS, 1982; Carley 1979). In 1980 the red wolf was declared by the Service to be extinct in the wild. (USFWS, 1982). This is the first time a species was deliberately rendered extinct in the wild for the purpose of furthering its conservation.

The red wolf recovery field crew worked with Point Defiance Zoo and Aquarium in Tacoma, Washington, and others to develop strict protocols for reliably distinguishing red wolves from coyotes and hybrids (USFWS, 1984). They also developed the facilities and techniques to breed the species in captivity and thereby successfully established the captive breeding program, which became the red wolf Species Survival Plan® (SSP) (Waddell and Long, 2015).

Carley and his team also conducted the first experimental island releases of captive-born red wolves on uninhabited Bulls Islands at Cape Romain National Wildlife Refuge in South Carolina. These island releases established elements that would be key to the survival and recovery of the species by demonstrating that captive-born red wolves released into the wild could learn to hunt, and that they could be effectively monitored and managed (Carley, 1979).

The release of 4 pairs of red wolves at Alligator River National Wildlife Refuge (Refuge), in Dare and Hyde Counties, North Carolina, in 1987 was the first attempt to reintroduce a carnivore to the wild. This release was accompanied by an ESA Section 10(j) rule with supporting analysis pursuant to the National Environmental Policy Act (NEPA) and other regulatory compliance documentation (51 Fed. Reg. 41790 – 41797 (Nov. 19, 1986) ("1986 10(j) rule")). ESA Section 10(j) permits the Service to establish experimental populations of species that are listed as endangered or threatened under the ESA. 16 U.S.C. § 1539(j).

The Federal Register notice that accompanied the final 1986 10(j) rule stated that up to 6 pairs of wolves (i.e., 12 animals) would be released and that the released wolves would remain within the boundaries of the Refuge and an adjacent military bombing range (the Dare County Bombing Range). 51 Fed. Reg. at 41793. The 1986 10(j) rule required the Service to recapture any animals that left the federal lands and return them to the Refuge.

Red wolves soon ventured off federal lands onto adjacent private lands and the red wolf program staff negotiated the first agreements with private landowners. The early landowner agreements were in the form of leases, which had the effect of adding those lands to the refuge system for the purpose of red wolf conservation and management (see, May 4, 1988 memorandum from Red Wolf Project Coordinator to the Regional Director). Providing a means for released wolves to use these private lands was biologically necessary because the Service's

Program staff learned that their prior assumptions about red wolf foraging and home range size - developed through observing the animals in southern Texas and Louisiana - were incorrect. Wolves released into the NENC NEP utilized different habitat and prey than had been previously observed; meaning that the existing federal lands could not support the population as originally assumed (Phillips et al., 2003).

Between 1987 and 1993 the program moved away from the practice of entering into lease agreements with landowners for the purpose of red wolf conservation to less formal written agreements and ultimately verbal agreements as relationships were built with individual landowners. The result was that red wolves were occupying private lands in contrast to the plain language of the 1986 rule, which had provided that the experimental population of red wolves would remain on federal lands and any wolves that left federal lands would be captured and returned.

Also between 1987 and 1992, 42 red wolves were released in the NENC NEP area. These releases were essential to building the population while managing inbreeding in furtherance of the conservation of the species. These releases were disclosed in subsequent Federal Register notices (see 60 Fed. Reg. 18940 (Apr. 13, 1995), Alligator River 5-Year Summary); but the number of wolves released during this time exceeded the authorization in the 1986 10(j) rule, which provided for the release of no more than 6 pairs of wolves.

The 1986 10(j) rule for the NENC NEP red wolves were revised in 1995. The 1995 rule revisions, which are currently the governing regulations, eliminated the requirement that the population be confined to federal lands, and included expanded provisions for the take of red wolves by private landowners, as a means of fostering landowner support for red wolf conservation efforts on private lands (60 Fed. Reg. 18940–48 (Apr. 13, 1995) ("1995 rule)).

Specifically, the 1995 rule revisions revised and clarified the incidental take provision; revised the livestock owner take provision; added harassment and take provisions for red wolves on private property; revised and clarify the vaccination and recapture provision; and applied the same take (including harassment) provisions to red wolves outside the NENC NEP area, except for reporting requirements.

After issuance of the 1995 rules the experimental population continued to steadily grow from 1995 to 1999. Although, the 1995 rule did not authorize the release of additional animals from the SSP, an additional 12 animals were released in the NENC NEP area during this time period. The continued augmentation of the population with releases from captivity, coupled with acceptable reproduction and survival rates enabled the population to grow throughout this period (Hinton et al. 2016). Reproductive rates and survival rates are both influenced by human-related mortality (Hinton et al. 2016). As such, the provisions in the 1995 rule that allowed for the management of red wolves on private lands and that aimed to foster cooperation with private landowners facilitated this continued growth of the population.

Despite being generally effective in terms of providing for continued growth of the NENC NEP red wolf population, by 1998 evidence of friction between private landowners and red wolf management began to emerge. Specifically, the owners of a large property immediately adjacent to the Refuge which had been inhabited by wolves since at least 1989 requested authorization to remove wolves from their property. In response, the Red Wolf Field Project Coordinator issued a proposed revised interpretation of the take provisions of the 1995 Section 10(j) rule (see February 5, 1999 memorandum from Brian T. Kelly to Jim Savery, and Don Temple, Subject: Guidelines for Applying Red Wolf Rules; hereafter referred to as the February 1999 memorandum). As indicated in the memorandum, field staff and management had come to

the conclusion that provisions of the 1995 rule specifying that landowners could request removal of wolves from their lands for any reason, and providing for the authorization of take of wolves under certain conditions could be detrimental to efforts to continue to grow the population. Materials that accompany the February 1999 memorandum identify an intent to revise the 1995 rule to reflect this view in the following couple of years in conjunction with the promulgation of rules to establish another experimental population. These actions did not occur; another experimental population was not established and the 1995 rule was not revised.

It was also during this time (the mid-1990's) that a change occurred that fundamentally altered the dynamics of the NENC NEP and red wolf conservation generally – the arrival of coyotes on the Albemarle Peninsula.

By the early to mid-1990's coyotes had become established on the Albemarle Peninsula and had begun to breed with red wolves (Kelly et al., 1999, Phillips et al., 2003). As noted above, it was the fact that red wolves and coyotes can and do interbreed that threatened the red wolf with extinction in southeastern Texas and southwestern Louisiana. One of the factors that led to the selection of the Refuge as the first reintroduction site in 1987 was that the range of the coyote had not yet expanded to include eastern North Carolina. The arrival of coyotes in the NENC NEP area renewed the threat that the red wolf genome would be subsumed into the coyote genome through genetic introgression.

In 1999 a workshop was convened in Virginia Beach that brought together over 40 red wolf experts. At this workshop, information was presented indicating that genetic introgression with coyotes could result in the loss of a unique red wolf genome within a few generations. Recognizing the urgency of the threat posed by coyotes, the workshop participants developed the innovative and bold Red Wolf Adaptive Management Plan (RWAMP) (Kelly et al., 1999).

The RWAMP divided the Albemarle Peninsula into management zones with different objectives for red wolf and coyote management within each. The zones were designed to prioritize management activities with the objective of maintaining a gradient from east to west across the Albemarle Peninsula; with the eastern end of the peninsula populated almost exclusively with red wolves (Zone 1), the western end populated with coyotes (Zone 3), and a zone in the middle (Zone 2) where coyote-red wolf interactions would be closely monitored and adaptively managed.

One of the challenges in implementing the RWAMP was the need for reliable methods to quickly distinguish between red wolves, hybrids and coyotes; as adult hybrids can vary greatly in appearance from nearly wolf-like to nearly coyote-like, and puppies are essentially indistinguishable. Miller et al. (2003) were able to develop a reliable test based on blood samples. The RWAMP also depended on the development of an effective means of managing intra-specific matings. The Service's experience in Texas and Louisiana had demonstrated that efforts focused on eradicating coyotes from the area were ineffective. The RWAMP pioneered the use of sterile placeholders to manage space and red wolf-coyote interactions (Seidler and Gese, 2012; Gese and Terletzky 2015). Implementation of these management practices also required the continued cooperation of private landowners (Kelly et al., 1999).

The RWAMP worked. Genetic introgression from the growing coyote population into the red wolf population was reduced (Bohling et al., 2016). The red wolf population continued to increase and by 2005 it reached a peak population of approximately between 130 and 150 animals and over 20 breeding pairs (U.S. Fish and Wildlife Service 2007, Hinton et al. 2016).

The RWAMP represented a bold and necessary change to the management of the NENC NEP. Its success also hinged on activities that were never envisioned, nor authorized in either the 1986 or 1995 Section 10(j) regulations.

The RWAMP effectively addressed the immediate threat to red wolves posed by the arrival of the coyote; namely genetic introgression (Bohling et al., 2016). It did not address the indirect threat posed by the arrival of the coyote (loss of red wolves associated with coyote control activities), and this threat would not begin to manifest itself until approximately 2005. As coyotes expanded their range and numbers throughout North Carolina and the eastern United States, citizens (including landowners and land managers on the Albemarle Peninsula) became increasingly concerned about the growing coyote population and interested in pursuing measures to control them (North Carolina Wildlife Resources Commission, 2012). Increases in coyote hunting and trapping efforts lead to increase proportions of red wolf mortality attributable to anthropogenic sources. Hinton et al. (2016) attributed the observed increase in the proportion of red wolves deaths attributable to gunshot to the tendency of hunters to mistake red wolves for coyotes.

From 2005 through 2010, because of the increase in human-related mortality, particularly by gunshot, the red wolf population in the NENC NEP plateaued while the number of breeding pairs and reproductive output declined (Hinton et al., 2016).

It was at this point that the take provisions in our 1995 regulations (and the field interpretation of those provisions as expressed in the February 1999 memo referenced above) came into increasing conflict with landowner desires to aggressively pursue coyotes. Landowners became increasingly concerned that their efforts to eradicate coyotes from their lands put them at risk of inadvertently violating the ESA by taking a red wolf. As such,

landowners recognized the need to obtain written authorization from the Service to take red wolves. In accordance with the view of the 1995 rule provided in the February 1999 memorandum, such authorizations were not being granted. Eventually, this tension led to a considerable decline in landowner cooperation, which greatly limited the Service's access to private lands and our ability to effectively manage the population.

Growing landowner frustration with local Service management led some landowners to reach out to the Service's senior management in the Regional Office. As the Regional Office began to delve into field operations of the Program they identified areas of potential concern regarding program management, supporting science and human dimensions. The Service contracted the Wildlife Management Institute (WMI) to conduct a review of the program (WMI, 2014). The review produced many findings, the most relevant of which was that "decisions made at the local level, although made with the best intentions and with the program's success in mind, did not always comply with the rules established for the reintroduction program." (WMI 2014, Executive Summary, pg. 3).

After the Service's senior leaders reviewed the WMI report they decided to bring management of the NENC NEP back into alignment with the 1995 rule by discontinuing the release of red wolves from the SSP into the NENC NEP, stopping the deployment of sterile placeholder coyotes, and fully implementing the provisions for authorizing take (See June 30, 2015 press release entitled, "Service Halts Red Wolf Reintroductions Pending Examination of Recovery Program").

4. **Rebuttal Expert Opinions**

a. Rebuttal Expert Opinion 1: The Prior Implementation of the Red Wolf Recovery Program Was Not Consistent with the ESA and Its Implementing Regulations

The actions of the Red Wolf Recovery Field Crew (e.g., the use of placeholders and the release of animals from the SSP into the wild) were essential to the growth of the population and the minimization of genetic introgression. However, these measures were neither expressly nor implicitly authorized by regulation. Additionally, field level management made their own interpretations of Service regulations (e.g., the February 1999 memorandum) without being delegated authority to do so (see, Fish and Wildlife Service Manual at 032 FW 5.2A(4)), and these interpretations were not approved by the Service Director. As a result, red wolf management efforts within the NENC NEP were inconsistent with applicable rules and official policy.

To correct this unauthorized interpretation, Service senior leadership limited management activities within the NENC NEP to only those explicitly authorized by the regulation, until such time as the Service could determine whether to revise the rules.

b. Rebuttal Expert Opinion 2: The Red Wolf Recovery Program, as Currently Constituted, Cannot Effectively Manage the Primary Threat of Human Intolerance of Red Wolves

The 1995 rule, particularly the take provisions (and the unauthorized interpretation of those provisions contained in the February 1999 memorandum), was effective at improving red wolf numbers only to the extent that it reconciled landowner concerns with red wolves and their management by limiting conflict with landowner interests. With the arrival of the coyote to the NENC NEP, conflict between red wolf management and landowner interests increased.

As stated in the 2016 report from the Red Wolf Recovery Team (U.S. Fish and Wildlife Service, 2016) the red wolf is a conservation-reliant species (see also Carroll et al., 2014) and is likely to remain so for the foreseeable future. To the Recovery Team "conservation reliance" means that the threats to the continued existence of this species are such that they cannot be eliminated or sufficiently controlled to allow red wolves to persist on the landscape without perpetual intensive federal management. For red wolves this requires the management activities identified in the RWAMP (e.g., use of placeholders, active removal of hybrids, and management of interspecific pairings) as well as the active management of human-related mortality. Discontinuation of these management practices to address these threats leads to a decline in the population.

In section 4.2 of his expert report, Dr. Vucetich contends that cessation by the Service of management practices described in the RWAMP works against red wolf recovery. I agree that, given that the red wolf is a conservation-reliant species, cessation of active management of the key threats to the species (e.g., inter-breeding with coyotes) substantially compromises the Service's ability to maintain and grow the wild red wolf population. However, Dr. Vucetich fails to acknowledge that discontinuation of active management can arise via a decision by Agency leadership, which occurred in 2015 as discussed above, or it can also arise via the loss of ability to implement management actions regardless of Agency intent. The latter has occurred in the NENC NEP area over the past several years, and has had a negative effect on the red wolf population that pre-dates any actions taken by the Service in 2015. Evidence of this includes the large number (over 400) of requests the Service received in 2014 from landowners requesting that wolves be removed from their lands and/or that they be issued take authorizations. Human intolerance of red wolves has existed for many years and the Service's inability to implement

management actions to address this threat has had important ramifications for the red wolf in the NENC NEP area and beyond.

More broadly, the historic range of the red wolf is predominantly private land, and there are no contiguous blocks of public land anywhere in the species' historic range that could contain a viable population of red wolves. Consequently, the conservation of the species ultimately depends on the development of effective means to ensure a sufficient level of co-existence between man and wolf. Because red wolves are conservation reliant and require active management, this necessarily implicates landowner's willingness to allow implementation of government management practices on their lands. As such, landowner attitudes are a critical consideration in red wolf conservation.

The Service's 1986 regulations attempted to foster tolerance of red wolf recovery efforts by maintaining red wolves on federal lands; the Alligator River NWR and Dare County Bombing Range. But this proved ineffective due to the inadequate size of the Federal land base.

The Service's 1995 revisions to the regulations attempted to promote coexistence with red wolves and cooperation with red wolf management practices through a system whereby the Service would remove red wolves from lands where they were not welcome or provide authorization for their removal. The Service did not fully implement these provisions initially; nonetheless, there was a sufficient level of landowner support (or lack of landowner concern) to allow the Program to continue to successfully grow the population. This condition persisted until the presence of red wolves began to interfere with landowner efforts to control coyotes. In the mid-2000's interest in coyote control began to rise throughout North Carolina. According to data from the North Carolina Wildlife Resources Commission (2012) the harvest of coyotes by trappers in North Carolina Coastal Plain counties increased from 2 coyotes during the 2003-2004

trapping season to 1,100 in the 2010-2011 season. Similarly, hunters took an estimated 4,045 coyotes in the Coastal Plain counties during the 2007-2008 hunting season (the first year such statistics were collected in North Carolina) compared to an estimated 10,261 coyotes taken during the 2010-2011 season.

As more North Carolinians pursued lethal control of coyotes the Service began to observe an increase in human-related red wolf mortality, which resulted in a leveling off or slight reduction in the overall red wolf NEP population (Hinton et al. 2016), and a noticeable reduction in the number of breeding pairs and reproductive output. The estimated number of red wolf breeding pairs and litters produced in the NENC NEP between the 2006-2007 and 2013-2014 breeding seasons were as follows:

	Breeding Pairs	Litters
2006-2007	20	11
2007-2008	18	11
2008-2009	15	11
2009-2010	15	9
2010-2011	16	10
2011-2012	17	9
2012-2013	13	7
2013-2014	8	5

(Source: US Fish and Wildlife Service, database)

Bohling and Waits (2015) explains that red wolves expanded primarily onto private lands where landowners "did not anticipate wolf colonization of their property, which has created friction between local communities and the [Service] as was highlighted in an independent review of the red wolf program (WMI, 2014). This conflict, combined with lack of protected refuges for wolves, lack of awareness among the hunting community, and proximity to the mainland coyote population, likely facilitates breeding pair disruption and the spatial pattern of hybridization events."

In section 4.3 of his expert report Dr. Vucetich fails to acknowledge that direct mortality is only one outcome resulting from interactions between landowners and red wolves and red wolf managers. I generally agree with most of what Dr. Vucetich puts forward in section 4.3 of his report regarding the detrimental effects of human-related mortality on the NENC NEP population. However, his report makes no mention of the fact that Service authorization of lethal take has resulted in the death of one red wolf over the 30-year history of the NENC NEP reintroduction effort. By contrast, the primary source of human-related red wolf mortality is unauthorized gunshot. This take can be apportioned into accidental shootings by coyote hunters and deliberate acts. The relative contribution of each is unknown, but for the purposes of this discussion I assume that most gunshot mortality is the result of mistaken identity. This assumption is also supported by scientific literature. See Hinton et al. 2013, 2015a, 2015b; and Newsome et al. 2015.

If most deaths of red wolves are due to mistaken identity with coyotes, there are various management strategies that could be employed to reduce this source of mortality. One potential solution would be to limit coyote hunting on the premise that less coyote hunting would equate to fewer opportunities for hunters to mistake red wolves for coyotes leading to less take of red wolves and a more robust red wolf population (see Newsome et al., 2015). In fact, the Service had objected to plans by the North Carolina Wildlife Resources Commission to expand coyote hunting rules to include nighttime hunting in 2013, on this premise (see April 16, 2012, letter from Service Regional Director to North Carolina Wildlife Resources Executive Director). However, this seemingly reasonable strategy is susceptible to failure due to unintended consequences.

Over the past few years, we have observed that restrictions on coyote hunting appear to have had limited effect on the continued decline of the red wolf population. It is possible that the restrictions generated a backlash that led to an increase in deliberate take of red wolves. Based on the evidence presented by Responsive Management (2016), showing that only 4% of respondents took direct action to the presence of red wolves on their property, it is my opinion that the effects of a direct backlash of this type has been relatively minor.

A more detrimental unintended effect of the coyote hunting restrictions was that it led more landowners to deny Service personnel access to their lands, which as mentioned above greatly limits the Service's ability to implement many of the practices needed to maintain and manage the population. Therefore, in my opinion, the net effect on the red wolf population of limiting coyote hunting has been negative.

Today, we are implementing the 1995 rule as written (with the exception of those provisions modified by the current preliminary injunction), and it is clearly not working, as evidenced by the continued steep decline in the population and absence of evidence of increased landowner support.

A great deal has been written about the subject of human attitudes toward wolves that I will not attempt to comprehensively summarize here (see for example Williams et al., 2002, and more recent work by Dr. Vuceitch (Bruskotter et al., 2014)). Most of this work is specific to gray wolves in the United States and Europe; though the findings are likely applicable to red wolves as well. One finding of particular relevance here is that while the public at large tends support wolf reintroduction efforts, people who live in the areas affected by reintroduction efforts tend to have a more negative view. Specific to red wolves, the best available information regarding human attitudes within the NENC NEP area is the survey conducted by Responsive

Management for the North Carolina Wildlife Resources Commission (2016). The data for this report were collected in 2016 and as such reflect residents' attitudes in consideration of all that has transpired relative to coyote and red wolf management on the Albemarle Peninsula to date.

Overall the Responsive Management survey found that 32% of Albemarle Peninsula residents who were surveyed support having red wolves on the Peninsula, while 39% of the survey group oppose red wolves. Another way of looking at these findings is that 68% of Albemarle Peninsula residents either oppose having red wolves in the area or are indifferent.

It appears reasonable to me to assume that it would take a fairly strong stimulus to compel a citizen to violate federal law (i.e., deliberately shoot a federally listed endangered species). Conversely, it would take relatively little motivation to offer more passive resistance. In this case, landowners could express their displeasure with red wolf recovery efforts by denying access to their property. It is not unlawful, and is most likely in keeping with their inherent tendency to control access to their land in any case. So, a relatively small agitation (i.e., restrictions on coyote hunting) is likely all that is needed to compel a landowner who is either mildly supportive or indifferent to red wolf conservation to become just upset enough to deny access to their property. In essence the bar for stimulating lawless behavior is much higher than the bar for simply withholding cooperative behavior. When that happens at a large scale (in terms of either number of landowners or number of acres affected) the Service's ability to employ the techniques needed to sustain the population is compromised and the population declines.

This is exactly the scenario that has faced the Service over the past few years in the NENC NEP as evidenced by the large number of landowner complaints that have been submitted to the Service since 2014.

Again, the approaches employed by the Service to date to foster landowner cooperation have proven ineffective. In my opinion the Service needs to try something different, which will require a rule change.

c. Rebuttal Expert Opinion 3: The Red Wolf Recovery Program, As Currently Constituted, is not Sustainable and Cannot Effectively Achieve Recovery of the Species

The fact that the red wolf is a conservation-reliant species presents another challenge to recovery efforts, and points to another reason for revision of the 1995 rules. The fact is that the intensity of management activities required to sustain this one population are such that it is not financially possible to replicate this level of effort at additional reintroduction sites, as would be needed to achieve recovery of the species. Currently, the Service allocates over $1 million per year to red wolf conservation; as much or more funding than to any other species in the Southeast Region. Since the Service's endangered species recovery budget is finite, allocating resources to one species necessarily means that fewer resources are allocated to other species.

To move toward recovery, changes are needed that make the Program both more effective and more efficient. A major inefficiency of the Program as currently configured is the way in which red wolves are regulated on private lands. The 1995 rule provisions that require the Service to attempt to remove red wolves from private lands necessitates that Service field staff devote considerable time to this activity, which adds to Program costs and limits time available for other activities that directly benefit the population. This has been recognized by Service field staff and management for many years as referenced in the February 1999 memorandum. Simply removing these provisions from the 1995 rule is one way to increase efficiency; though, it would likely lead to some of the unintended consequences discussed above. In my opinion, what is needed is a Program, and accompanying set of rules, that actively engages

landowners in red wolf conservation and management, fosters coexistence, engages the North Carolina Wildlife Resources Commission, and interested non-governmental organizations. Active engagement of all these parties is, in my opinion, the only practical means of building the capacity needed to effectively achieve red wolf recovery in North Carolina and beyond.

d. Rebuttal Expert Opinion 4: The Service Requires Sufficient Time to Reevaluate the Red Wolf Recovery Program and Formally Adopt a New Policy and/or Regulations as Needed

To succeed, the Red Wolf Recovery Program must again adapt and lead. This time the need is to find a new means of furthering the conservation of red wolves that recognizes the conflicting nature of landowner interests and needs on a landscape that is predominantly in private ownership. However that balance is ultimately achieved, it must be formally codified as necessary under the ESA in accordance with Federal rule-making procedures.

Federal rule-making procedures, while time consuming, are also a highly deliberative process that is designed to elicit robust expert and public input. As indicated by the announcement made by the Service in September 2016 and the Service's March 2017 Federal Register notice, the Service is currently in the process of revising the existing Section 10(j) rules and conducting a new NEPA analysis.

During the rule-making period, it is likely that the NENC NEP will continue to decline. It is my professional opinion that this is unavoidable. Efforts to slow or reverse the decline of the NENC NEP in the near term outside of rule-making, such as limiting landowner ability to manage coyotes, will further harden public attitudes against red wolf conservation. This will make it considerably more difficult to build a population of red wolves in the NENC NEP or elsewhere over the long term. The cooperation of private landowners is the key to red wolf recovery; along with effective engagement of State wildlife agencies and non-governmental

organizations. The most important contribution landowners provide is access to their lands by red wolves and the Service's staff. When the Service loses access to private lands its ability to effectively conserve this species is lost. So, while I generally agree with Dr. Vucetich's opinion (section 4.2 of his report) that the NENC NEP will continue to decline and possibly become extirpated in the absence of releases from the SSP and active management of hybridization, what he fails to acknowledge is that these practices cannot be implemented over most of the NENC NEP area without landowner support, regardless of the Service's intentions.

The Service's efforts resulted in the growth of the NENC NEP red wolf population from zero to approximately 150 between 1987 and around 2005. I am confident that the population could grow again, in the NENC NEP and elsewhere within the historic range of the species, given the proper regulatory and non-regulatory tools. These may include the tools contained in the RWAMP to manage genetic introgression, releases from the captive population to manage inbreeding and genetic diversity, and effective tools to foster adequate landowner and other stakeholder cooperation. Indeed, the analysis by Faust et al. (2016) showed that the NENC NEP could experience positive growth with reasonable reductions in the amount of human-related mortality, continued releases of captive-born animals, and continued management of pairings between red wolves and coyotes.

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Red Wolf Recovery Program Adaptive Work Plan FY00-FY02

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PREFACE

This plan specifies the framework and general goals of an adaptive management plan by which the feasibility of controlling red wolf/coyote hybridization will be assessed. This plan specifies annual goals. However, the plan retains the flexibility to adapt to new findings, either from the analysis of the data collected during the implementation of the plan or from the findings of modeling efforts of research partners (see below I, 2 and 3), or both. The intent of this version of the plan is to specify the core components and basic goals of a plan by which the hybridization threat can be assessed and managed in a logical, adaptive (scientific–see I below) framework. From this core framework, the data it is designed to collect, and the modeling efforts and sensitivity analysis currently underway, the Red Wolf Advisory Team will be able to assess the program's progress and make recommendations regarding adaptions (changes) to the plan. The red wolf recovery program is currently working under a 3-5 year time-line to determine whether wild red wolves and sympatric eastern coyotes can coexist and still maintain the genetic identity of red wolves. This plan covers a 3 year time-line. If results at the end of this period (or before) indicate clearly that the red wolf either is or is not recoverable in the wild, the appropriate actions should be undertaken.

PURPOSE AND BACKGROUND

The purpose of this plan is to specify the goals and implementation strategy of an adaptive management plan that was designed to assess, control and manage hybridization occurring between red wolves and coyotes in the only extant population of red wolves in the United States. The U.S. Fish and Wildlife Service began restoring red wolves to the wild in 1987. Red wolves had been declared extinct in the wild in 1980. The history of the red wolf reintroduction program prior to the temporal scope of this plan is well documented (Kelly and Phillips, in press, Phillips et al in press, Gilbreath 1998, Phillips et al. 1995).

During the week of April 12, 1999, at the request of the U.S. Fish and Wildlife Service, a 3.5 day facilitated workshop was conducted by the Conservation Breeding Specialist Group (CBSG) of the IUCN's Species Survival Commission. The purpose of this workshop was to gather together experts who had studied wolves, coyotes, genetics, modeling and canid population biology to discuss the biological and ecological issues facing red wolf recovery. Four subject

areas were identified to be the focus of the workshop: (1) red wolf population monitoring, (2) red wolf hybridization with coyotes, (3) selection of additional release sites, and (4) the role of the captive breeding program.

After reviewing data on the reproduction of red wolves in the wild, the attendees of this workshop concluded that the proportion of hybrid litters from red wolf/coyote interbreeding was alarmingly high, and recommended that the workshop focus solely on issues surrounding red-wolf/coyote hybridization, including: how much hybridization could occur in the population in northeastern North Carolina (NENC) while still maintaining its genetic integrity, how to assess the degree of hybridization in the population, and how to limit hybridization to acceptable levels on a landscape scale. This workplan details an adaptive management approach (Holling 1978, Walters 1986) to these issues that is based on the recommendations from the CBSG workshop (Kelly et al. 1999).

ORGANIZATION OF THIS DOCUMENT

This plan is organized into 3 sections: (I) an overview of the adaptive management paradigm and a discussion of how the red wolf adaptive management plan (RWAMP) is consistent with this paradigm, (II) a description of the experimental approach of the adaptive plan, and (III) goals of the plan and measures by which adaptions to this plan should be based.

(I) Adaptive Resource Management and the Red Wolf Recovery Program

Adaptive resource management (ARM) is an approach derived from the need to blend research and management. To be effective resource stewards, wildlife managers should refrain from conducting research and management independently. Instead, sound scientific principles should be applied to solve problems. Adaptive management provides the paradigm by which this can be accomplished (Lancia et al. 1996).

Adaptive management is characterized by a 4 step process (Walters 1986): (1) reach a consensus among stakeholders, (2) analyze existing data and model preliminary predictions regarding various management schemes, (3) assess how sensitive predictions are to changes in various assumptions and variables, and (4) implement management in an experimental context. Adaptation of a plan is effected via feedback from experimental results generated in step. Because

the red wolf recovery program (RWRP) was seen to be in a crisis stage by the participants of the CBSG workshop, the RWRP did not adhere to the sequential implementation of this process. Instead, based on the results of the CBSG workshop (Kelly et al. 1999), several of the 4 steps outlined above were engaged simultaneously. Nonetheless, the Service's mission of working with others and basing decisions on sound science is consistent with the adaptive management paradigm and provided somewhat of a head-start on the 4 steps mentioned above. The current state of each step is detailed below.

Reach a Consensus among Stakeholders (1)

In the ideal ARM paradigm, all stakeholders concede something to implement a plan. In the context of the red wolf recovery program, red wolves are reintroduced under the experimental non-essential (ENE) designation available in section 10(j) of the Endangered Species Act. This designation allows for a weakening of the provisions of the act that prohibit the take of an endangered species. So in a broad sense, advocates of wolf introduction and restoration conceded some protection of wolves to accomplish restoration; and, by having greater flexibility to take wolves, opponents to wolf restoration were more amenable to wolves on their land. The rule-making process associated with an ENE designation provides the forum for reaching consensus. This process typically involves public meetings and written comment periods that result in the revision of a proposed rule to reflect consensus. The red wolf program followed such a process to derive its current management rule. However, the advent of a serious threat to recovery from hybridization precipitated the need to change the current red wolf rule. Prior to initiating the rule changing process, the RWRP pro-actively conducted open houses in the local communities to inform stakeholders of the need to change the rule and described conceptually the Adaptive Plan being proposed. Although the rule package has not yet been published for public comment, the open houses have functioned to inform and begin the process of generating consensus.

Analyze Existing Data and Generate Models (2)

In an effort to better understand how red wolves live in the wild, data collected during the reintroduction program is beginning to be analyzed (Phillips et al. in press, VanManen et al. 1999,

Kelly 1994). However, prior to the CBSG workshop no analysis had examined hybridization. Participants of the CBSG workshop crafted a deterministic model of coyote genetic introgression into the NENC red wolf population. This model revealed the current red wolf population could sustain very little hybridization if it was to maintain its genetic identity. As a result of the predictions of this model, the participants of the CBSG workshop made recommendations from which the current adaptive management plan was conceived (see II below). However, these recommendations and the adaptive plan are based on a theoretical model of the space use and behavior of sympatric red wolves and coyotes. Little empirical data exist on this topic. Since the CBSG workshop, the Service, via partners at Universities, have initiated research projects to address this dearth of data. In the interim, models of redwolf/coyote/hybrid interactions are being developed from theoretical information, published data on other populations and similar species (e.g., gray wolves).

Assess How Sensitive Predictions Are To Changes In Assumptions and Variables (3)

After the CBSG workshop, the Service contracted with research partners to assess the sensitivity of the models on which the adaptive plan is based. A sensitivity analysis of the introgression model is currently underway. Likewise, a red wolf/coyote/hybrid spatial use model is currently being developed. Results from these analyses may identify variables or assumptions which significantly effect the predictions of the models. Field efforts can then be directed to collect data on these key variables or to test key assumptions so that the models can be refined with empirical data from red wolves, coyotes and or hybrids in NENC. Eventually, ideally after empirical data from NENC are incorporated, the introgression and spatial models will be integrated to assess the overall impact of hybridization on a landscape scale and help determine whether the adaptive plan is working.

Implement Management in an Experimental Context (4)

See III below (Implementation Of The Plan And Measures By Which Adaptions Should Be Based) for information on how the red wolf program is implementing this component of the adaptive management paradigm.

(II) Goals Of The Adaptive Plan And A Description Of The Experimental Approach

The goal of the red wolf adaptive plan is to reduce hybridization between red wolves and coyotes to a level that does not threaten the long term genetic integrity of the red wolf in the wild. There are 2 fundamental approaches to achieving this goal: (1) is to attempt to control coyotes (i.e., to pro-actively and opportunistically remove them from the population), and (2) is to capture, sterilize, radio-collar and release coyotes until wolves can take their place. With respect to 1, man's inability to control coyotes is noteworthy. Recall that wolves were rather easily exterminated from the U.S. during the predator control efforts of the early 20th century, while at the same time the range of the coyote increased. Efforts to reduce domestic lamb losses to coyote predation by killing coyotes further illustrates the futility of trying to control coyotes. Decades of effort have been spent trying to remove coyotes to protect domestic lambs from predation. However, because coyotes are territorial and typically kill lambs to provision their pups, research is currently underway by the U.S. Department of Agriculture to test whether sterilized coyotes will function to protect lambs by defending their space against coyotes that need to provision pups. It is this concept of holding space that is being applied to manage hybridization and help save the red wolf.

There are 2 primary components of the red wolf adaptive plan, one is to eliminate "zones of ignorance", and the other is to insure that all known breeding units are red wolf. Areas where we are unaware of what type of canid, if any, is present, or when we know a red wolf is present but are unaware of whether it is part of a breeding group or is nomadic (Crabtree 1988) or transient (Windberg and Knowlton 1988) are referred to as "zones of ignorance". To illustrate, if a giant slice of swiss cheese were overlaid on the landscape, the cheese would represent the area occupied by known red wolf breeding groups and the holes would be the "zones of ignorance". Sterilization not only achieves the primary goal of the adaptive management plan (limit coyote introgression) but also provides a biological means by which "zones of ignorance" can be systematically eliminated. Eliminating zones of ignorance represents a critical intermediate step in transitioning to a landscape that is occupied predominantly by red wolf breeding groups (transition from swiss cheese to provolone).

However, the underlying tenet of this approach is that space (territories) is limited and that

non-breeding pairs of coyotes, non-hybridizing mixed pairs, and breeding wolf pairs are best to occupy that space because the introgression of non-red wolf genes will be controlled and space will be limited or unavailable for other pairs to establish themselves. This underlying tenet however, assumes that coyotes and red wolves do not share space, are antagonist towards each other when not paired, and exclude one another from their respective territories. As mentioned earlier, data to test these assumptions currently do not exist but will be collected as the hybridization adaptive management progresses.

(III) Implementation Of The Plan And Measures By Which Adaptions Should Be Based

The red wolf adaptive plan is framed around the following biological seasons:

October - January:	Pre-breeding/Pair Bonding
February-March:	Breeding
April-May:	Whelping
June-September:	Pup-rearing.

Goals, by season, and general methods of the RWAMP are presented below. These goals will be implemented in a priority order according to 3 zones identified during the CBSG workshop (Figures 1 and 2). For example, if the goals withing Zone 1 have not been achieved, pursuit of those goals in Zone 2 should not be undertaken. An outline of foals and tasks follow:

1. October - January (Pre-breeding/Pair Bonding):
    a. Insure known breeding wolf groups are wolves
        i. Capture and assess ID and disposition[1] of the members of each group.

[1] See appendix A for a key by which untagged animals are identified and their disposition determined.

b. Relocate ***each member*** of ***each group*** a minimum of ***30 <u>usable</u>*** locations sampled appropriately throughout this season. Log, enter and plot locations within a week of when they are collected.

c. Summarize data for Advisory Team Meeting.

d. Convene Advisory Team after the holidays but before March.

2. February-March (Breeding):

   a. Continue with objective 1 if not yet completed.

   b. Identify with whom suspected lone wolves are associating (address partial zones of ignorance):

      i. Capture, and assess ID and disposition[1] of every animal caught while trapping for suspected associates

      ii. Use remote cameras, observation and scat surveying to focus capture efforts.

   c. When "b" is completed focus can shift to addressing complete zones of ignorance (areas where we have no canids collared):

      i. Capture, assess ID and disposition[1] of every animal caught

      ii. Use remote cameras, observation and scat surveying to focus capture efforts

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[1] See appendix A for a key by which untagged animals are identified and their disposition determined.

d. Relocate ***each collared animal*** a minimum of ***30 <u>usable</u>*** locations sampled appropriately throughout this season. Log, enter and plot locations within a week of when they are collected.

e. Survey ARNWR for presence of coyotes or hybrids (e.g., scat surveys for genetic ID).

3. April-May (Whelping):
   a. Continue with objective 2 if not yet complete.

Figure 1. Location of red wolf recovery area.

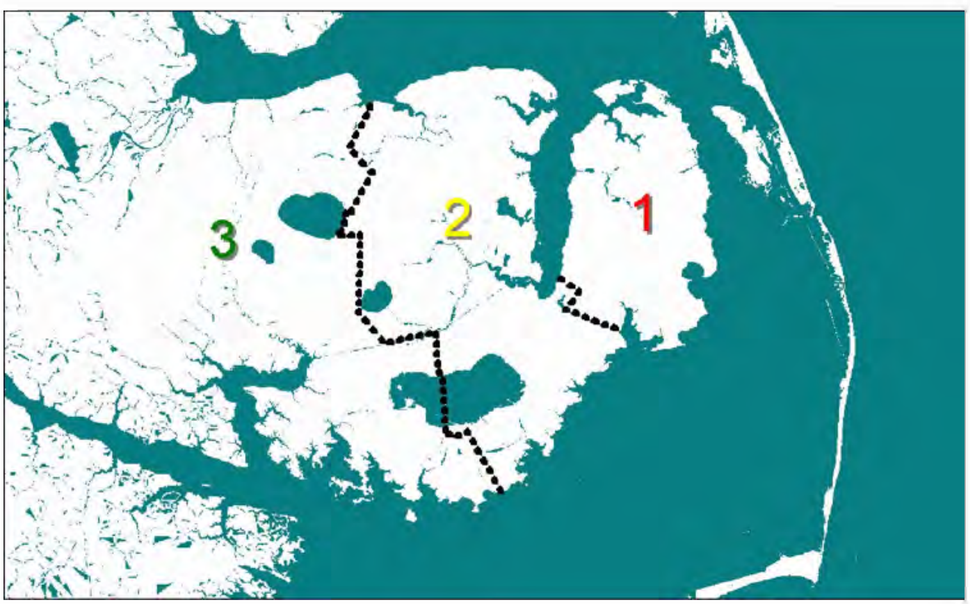

Figure 2. Close-up of designated red wolf recovery area and the management zones specified in the red wolf adaptive management plan: (1) is priority or "coyote free" zone, (2) is secondary or "experimental zone", and (3) is tertiary or "hybrid zone".

b. Monitor **all *breeding age*** canids (including those sterilized) during these months to ascertain whether they exhibit localized movements.

c. If non-wolf females localize movement, effort should be made to determine if she has whelped (find the den).

d. If wolf females localize movements, location and date should be recorded.

e. Relocate ***each collared animal*** a minimum of ***30 usable*** locations sampled appropriately throughout this season. Log, enter and plot locations within a week of when they are collected.

f. Consider releases.

4. June-September (Pup-rearing):

a. Relocate ***each collared animal*** a minimum of ***30 usable*** locations sampled appropriately throughout this season. Log, enter and plot locations within a week of when they are collected.

b. Summarize data for Advisory Team Meeting.

c. Convene Advisory Team in late summer (before Oct. Field Season)

d. Conduct insertions.

These seasonal goals are biologically justified. Focusing on known breeding groups of wolves during pre-breeding insures the ability to capture and begin tracking wolves that will serve as dispersers into the population. That is, they represent a large, annually available source of wild

wolves. Known wolf groups can easily contribute (by several orders of magnitude) more wolves to the population than both island projects. Since known wolf groups represent the cheese, they should not be exposed to activities during the breeding and whelping seasons that may compromise their ability to raise offspring for recruitment into the population (e.g., disturbing, tagging, or sampling, neonates--less than 12 weeks old--in or at den sites). Focusing on the known wolves during pre-breeding avoids or minimizes disturbance to them during gestation and lactation and helps insure pup survival. In contrast, the focus on partial and complete zones of ignorance during the breeding and into the whelping season (if necessary) minimizes the production of hybrids (maximizes our control of hybrid production). See Knowlton (1972) for a discussion of the temporal effectiveness of coyote control and why control during the breeding season is so effective.

The approach outlined above will simultaneously stop known introgression, reduce zones of ignorance, provide data to test key hypotheses and allow for the determination of whether the RWAMP is working (i.e., is the red wolf recoverable in the wild). Specific measures used to evaluate the plan follow.

The hypotheses listed below (P1-P3) were stated as null hypotheses in a proposal from the RWRP to the NC Wildlife Resource Commission (Kelly 1999), they are restated here as predictions:

P1: Red wolves are territorial to the exclusion of pairs or groups of coyotes.

P2: Coyote territories are smaller than red wolf territories.

P3: Red wolves directly (inter-specific aggression) cause coyote mortality.

Additionally, the following predictions need to be tested to determine the overall efficacy of the RWAMP:

P4: The number of known red wolf breeding units increases over time.

P5: The percent of land occupied by red wolves is greater over time.

P6: Total number of known "breeding" pairs or groups (sterilized pairs, and red wolf pairs) increases with time.

P7: The number of sterilized animals decreases over time.

P8: The number of mixed pairs that change to wolf pairs is greater than the number of wolf pairs that change to mixed pairs.

P9: The percent of the known reproduction (red wolf and hybrid) that is hybrid decreases overtime.

P10: The number of hybrids captured decreases over time.

P11: The percent hybrid litters is on a trajectory to a value that is consistent with maintaining 90% of the founding genetic diversity for 100 years (1-2% of the red wolf reproduction is hybrid).

Statistically, testing some of these predictions may be problematic. Many are cast as time series data and a lack of independence of observations may be an issue, especially for analysis of variance and linear regression techniques. However, many can be cast as null models which should enhance their test-ability. Nonetheless, the most appropriate means by which these predictions are tested is dependant on the review of the Advisory Team.

Table 1. Red wolf adaptive management plan predictions and data needs.

Prediction	Data Currently being collected?	If No, Does Plan Address?
P1*	No	Yes, n>30 locations/animal/season
P2	No	Yes, n>30 locations/animal/season
P3	Yes	
P4	Yes, baseline established	
P5*	No	Yes, n>30 locations/animal/season
P6	Yes, baseline established	
P7	Yes, baseline established	
P8	Yes	
P9	Yes	
P10	Yes, baseline established	
P11	Yes	

* P1 and P5 are ***KEY*** to determining the underlying tenet of this plan that space is limiting and red wolves will exclude coyotes. Data with regard to these predictions is critical to assess the feasability of managing hybridization, and thus whether red wolves can coexist with eastern coyotes.

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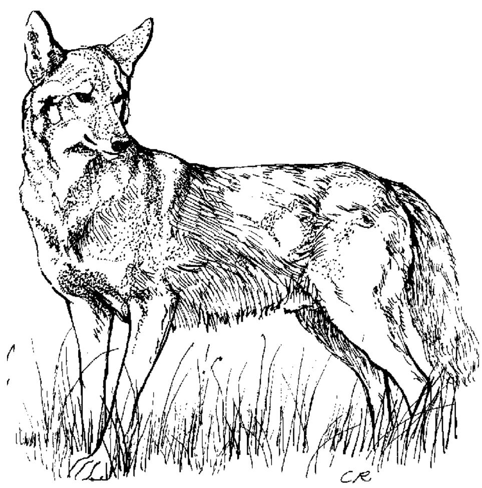
Appendix A. Key to determine ID and disposition of wolf-like canids in NENC.

	Question or Action	If, Yes...	If, No...
1	Is canid previously marked but not genetically identified?	2	4
2	Is both a sire and dam associated with the canid?	3	4
3	Are suspected (listed in database) sire and dam from captive stock or have both been genetically identified?	6	5
4	Was canid captured as a result of targeting a known group?	5	14
5	Morphologically, does canid appear wolf-like (does it meet standards)?	6	8
6	Are there extenuating circumstances to suggest the animal may not be a wolf?	8	7
7	***Process as a wolf and release***		
8	Is canid believed to be a puppy (<1yr old)?	9	17
9	Is pen space available to hold puppy?	10	11
10	***Hold pup pending genetic identification***		
11	Is there a need for the sex of the canid as a release candidate?	12	19
12	Could pen space be made available by euthanizing an unknown canid of the opposite sex?	13	17
13	***Euthanize an animal being held for genetic id of an opposite sex–place canid in pen***		
14	Does the canid have any suspected siblings that have been tested genetically?	15	16
15	Did the canid's suspected siblings test as a wolf?	5	16
16	Does morphology appear wolf-like (does it meet the standards)?	6	17
17	Is animal from land where sterilization of non-red wolves (coyotes and or hybrids) is ok?	18	19
18	***Sterilize, process and release***		
19	***Euthanize***		

Red Wolf Recovery Program Adaptive Work Plan



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U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

PREFACE

This plan specifies the framework and general goals of an adaptive management plan by which the feasibility of controlling red wolf/coyote hybridization will be assessed while efforts to restore red wolves to northeastern North Carolina (NENC) continue. This plan specifies core components designed to meet annual goals; however, it retains the flexibility to adapt to new findings, either from the analysis of the data collected during the implementation of the plan or from the findings of modeling efforts of research partners (see below I, II and III), or both. From this framework, the data it is designed to collect, and the modeling efforts and sensitivity analysis currently underway, the Red Wolf Recovery Implementation Team (RWRIT) will be able to assess the program's progress and make recommendations regarding adaptations to the plan.

PURPOSE AND BACKGROUND

The purpose of this plan is to provide the implementation strategy and goals of adaptive management which are designed to assess, control and manage hybridization occurring between red wolves and coyotes while restoring the only extant population of red wolves in the United States. Red wolves had been declared extinct in the wild in 1980. The U.S. Fish and Wildlife Service began restoring red wolves to the wild in 1987. The history of the red wolf reintroduction program prior to the temporal scope of this plan is well documented (Phillips et al 2003, Gilbreath 1998, Phillips et al. 1995).

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(I) Adaptive Resource Management and the Red Wolf Recovery Program

Adaptive resource management (ARM) is an approach derived from the need to blend research and management. To be effective resource stewards, wildlife managers should refrain from conducting research and management independently. Instead, sound scientific principles should be applied to solve problems. Adaptive management provides the paradigm by which this can be accomplished (Lancia et al. 1996).

Adaptive management is characterized by a 4 step process (Walters 1986): (1) reach a consensus among stakeholders, (2) analyze existing data and model preliminary predictions regarding various management schemes, (3) assess how sensitive predictions are to changes in various assumptions and variables, and (4) implement management in an experimental context. Adaptation of a plan is effected via feedback from experimental results generated in step. Because the red wolf recovery program (RWRP) was seen to be in a crisis stage by the participants of the CBSG workshop, the RWRP did not adhere to the sequential implementation of this process. Instead, based on the results of the CBSG workshop, several of the four steps outlined above were engaged simultaneously. Nonetheless, the Service's mission of working with others and basing decisions on sound science is consistent with the adaptive management paradigm and provided somewhat of a head-start on the four steps mentioned above. The current state of each step is detailed below.

Reach a Consensus among Stakeholders (1)

In the ideal ARM paradigm, all stakeholders concede something to implement a plan. In the context of the red wolf recovery program, red wolves were reintroduced under the experimental non-essential (ENE) designation

available in section 10(j) of the Endangered Species Act. This designation allowed for a weakening of the provisions of the act that prohibit the take of an endangered species. So in a broad sense, advocates of wolf introduction and restoration conceded a higher level of protection of wolves to accomplish restoration; and, by having greater flexibility to take wolves, opponents to wolf restoration were more amenable to having wolves on their land. The rule-making process associated with an ENE designation provides the forum for reaching consensus. This process typically involves public meetings and written comment periods that result in the revision of a proposed rule to reflect consensus. The red wolf program followed such a process to derive its current management rule; however, the advent of a serious threat to recovery from hybridization precipitated the need to change the current red wolf rule. Prior to initiating the rule-changing process, the RWRP pro-actively conducted open houses in the local communities to inform stakeholders of the need to change the rule and described conceptually the adaptive plan being proposed. Although the RWRP is assessing the data to determine if further rule changes are indeed necessary, the open houses have functioned to inform and begin the process of generating consensus. Additionally, RWRP personnel continue to present and discuss strategies of the RWAMP opportunistically with landowners and other members of the local public, particularly when management activities are conducted on non-federal land.

Analyze Existing Data and Generate Models (2)

Prior to the CBSG workshop, no analysis had examined hybridization between the reintroduced population of red wolves and the eastern coyote and little empirical data existed on this topic. Participants of the CBSG workshop crafted a simple, theoretical, deterministic model of coyote genetic introgression into the NENC red wolf population. This model apparently indicated the current red wolf population could sustain very little hybridization if it was to maintain its genetic identity. Since this model, the workshop recommendations and therefore much of this adaptive management plan were based largely on theoretical information, the Service, via partners at universities, initiated research projects to address the dearth of data and to construct more applicable models to guide management decisions and actions.

The projects deemed requisites to controlling hybridization were a genetic test to distinguish pure red wolves from hybrids, and a more substantial model of coyote introgression. As more information has been gathered, additional models of social interactions between sympatric red wolves and coyotes, and red wolf survival analysis were to be undertaken.

Assess How Sensitive Predictions Are To Changes In Assumptions and Variables (3)

At the CBSG workshop, the need to assess the sensitivity of the models that would guide the current plan and future adaptations was evident. Field efforts would collect data on key variables or to test key assumptions, but collecting this data would not detract from affecting change in the population towards achieving recovery goals. The models would then be refined with empirical data from red wolves, coyotes and/or hybrids in NENC as these data became available and the models would serve to influence future management recommendations.

As an example of the sensitivity assessment of the introgression model, a recent modeling run was conducted where 75% of hybrids and mixed pairs were sterilized. This scenario had a large impact on the integrity of the red wolf genome with 30-year projections predicting greater than 90% retention. Simulation of removal of hybrids was not nearly as effective. The introgression model to date would support the hypothesis that sterile hybrids are functioning as effective place holders, thereby reducing the rate of emigration of hybrids and potential introgression into the red wolf population.

Likewise, a red wolf/coyote/hybrid spatial use model is currently being developed, based on empirical results derived from the field component of the red wolf recovery program in NENC. Results from these analyses may identify variables or assumptions that significantly affect the management options best tailored for reducing wolf-hybrid encounters and maximizing available space for wolf colonization. Ideally, the introgression and spatial models will eventually be integrated to assess the overall impact of hybridization on a landscape scale and help determine how effective the adaptive management plan is.

Implement Management in an Experimental Context (4)

See III below (Implementation of the Plan and Measures by which Adaptations should be based) for information on how the red wolf program is implementing this component of the adaptive management paradigm.

(II) Goals of the Adaptive Plan and a Description of the Experimental Approach

The goals of the RWAMP are to (1) reduce interbreeding between red wolves and coyotes to a level that does not threaten the long term genetic integrity of the red wolf in the wild while simultaneously (2) building and maintaining the wild red wolf population from the east to west of the NENC recovery area (see Figures 1&2). Achievement of the first of these goals is approached by eliminating the breeding potential of coyotes within the study area through removing some coyotes immediately upon capture and by sterilizing, radio-collaring and releasing others. This adaptive approach allows for the second of the plan's goals, namely increasing the wolf population.

Man's inability to control coyotes is noteworthy (Lantz, 1905; Balser, 1974). Recall that wolves were rather easily exterminated from the U.S. during the predator control efforts of the early 20th century, while at the same time the range of the coyote increased. Decades of effort have been spent trying to remove coyotes to protect domestic lambs from predation. However, efforts to remove the offending individuals are often problematic and produce inconsistent results (Conner et al., 1998; Sacks et al., 1999b). Because coyotes are territorial and typically kill lambs to provision their pups (Till and Knowlton, 1983; Sacks et al., 1999a), researchers began testing whether surgically-sterilized but hormonally-intact coyotes could function to protect lambs by defending their space against coyotes needing to provision pups (Bromley and Gese, 2001a; Bromley and Gese, 2001b). It is this concept of holding space that is being applied to manage hybridization by providing managers time, information, and a higher degree of control over the recovery landscape, while simultaneously providing reproductive advantage to the red wolf.

Eliminating "zones of ignorance" is the primary component of the management process to ensure that all intact (breeding) pairs are wolves. These "zones of ignorance" are areas where no known canid is present, or where a nomadic (Crabtree 1988) or transient (Windberg and Knowlton 1988) red wolf is present but its status is unknown. Sterilization of coyotes and hybrids not only achieves one of the goals of the RWAMP by limiting coyote genomic introgression, but it also provides a biological means by which zones of ignorance can be systematically assessed and eliminated., a critical intermediate step in the transition to a landscape occupied predominantly by red wolf breeding groups. Ultimately, sterilization is a method that allows territorial space to be held until that animal can be replaced naturally or by management actions.

The underlying tenet of this approach is that space, and therefore territories, is limited on the recovery peninsula. Given a small, introduced wolf population, that space is initially best occupied by breeding pairs of wolves, non-breeding mixed (wolf/coyote) pairs, and non-breeding coyote pairs. In this way, introgression of non-wolf genes will be controlled and territories will be unavailable for colonization by intact coyote or mixed pairs. As the wolf population grows, having space available to dispersing wolves becomes increasingly important and this space is provided through natural interspecific behavior and/or management actions.

(III) Implementation of the Plan and Measures by which Adaptations should be based

The RWAMP is framed around the following biological seasons:

Months	Biological Season	Associated Field Work
October - January	Pre-breeding/Pair Bonding	Trap wolf groups to ID and radio collar
February-March	Breeding	Address partial zones of ignorance
April-May	Whelping	Den work: transponder and ID pups
June-September	Pup-rearing	Survey zones of ignorance

Goals, by season, and general methods of the RWAMP are presented below. These goals will be implemented in a priority order from Zone 1 through Zone 3, according to the three zones identified during CBSG workshop and later modified (Figures 1 and 2). Implementation of this plan is reviewed twice annually, usually in spring and late summer. An outline of goals and tasks follow:

1. October - January (Pre-breeding/Pair Bonding):
    a. Confirm and monitor the identification and disposition of individuals within known wolf groups.
        i. Capture and assess ID of wolves (pack members) not previously captured and/or identified. ID is determined by genetic analysis of blood samples, morphological measurements and pedigree data.
        ii. Confirm the presence, via recapture or survey, of previously identified and radio-collared wolves that have disappeared. Surveys methods can include identification of tracks, scat, or images from remote cameras as well as visual observations of

wolves themselves. The presence of a breeder may be confirmed from genetic assessment of pups at time of their capture.

        iii. Capture and radio collar pups identified and implanted with transponders at the den the previous whelping season, as needed.

    b. Provide space for dispersing or inserted wolves.
        i. Remove sterile space-holders.
        ii. Identify associates of previously suspected lone wolves, and remove non-wolf canids (see 2.b.i-iii.)
    c. Conduct insertions of wolves into areas previously occupied by coyotes or hybrids.

2. February-March (Breeding):
    a. Continue with objective 1.a. through March 15th for areas not completed during the pre-breeding season.
    b. Determine genomic identity of new associates of previously suspected lone wolves to prevent hybrid mating (i.e., address partial zones of ignorance):
        i. Capture, and assess genomic identity and decide disposition of every animal caught while trapping for suspected associates.
        ii. Genomic identity is determined by genetic analysis of blood samples, morphological measurements and pedigree data.
        iii. Use survey methods (see 1.a.ii.) to focus capture efforts and address zones of ignorance. Additional survey methods appropriate to this objective include siren surveys and public reports.
    c. When 2.b. is completed focus can shift to addressing zones of ignorance.
    d. Survey Zone 1 for presence of coyotes or hybrids (e.g., scat surveys for genetic ID).

3. April-May (Whelping):
    a. Monitor all breeding-age canids (including sterilized ones) to ascertain whether they exhibit localized movements.
        i. If non-wolf females or female associates of non-wolf males localize movement, efforts should be made to determine whether she has a litter, and, if so, it should be removed.
        ii. If wolf females localize movements, try to locate the den beginning one week after the suspected whelping date. Blood samples should be taken from each pup for genetic analysis, and transponders inserted. Litters identified as non-wolf following genetic analysis should be removed.
    b. Selectively cross-foster wolf pups or litters from wild or captive litters.
    c. Continue with objective 2.c. if not yet complete.

4. June-September (Pup-rearing): Continue addressing zones of ignorance.

5. Year-round efforts; to the extent possible:
    a. Relocate each radio-collared wolf via ground and aerial telemetry and use of satellite or GPS collars a minimum of 10 or more usable locations sampled per biological season.
    b. Gather data relevant to assessing dispersal patterns of red wolves, coyotes, and coyote-red wolf hybrids.
    c. Gather data essential to assess demographic parameters of the red wolf population necessary to assess viability of the red wolf population.

Seasonal variation in behavior dictates the timing for implementation of these goals. Focusing on known breeding groups of wolves during pre-breeding not only insures the ability to capture and begin tracking wolves that will serve as dispersers into the population, but also avoids exposing known wolf groups to activities (e.g., trapping and handling) during the breeding season that may compromise their ability to breed and produce a litter. In contrast, the focus on zones of ignorance during pre-breeding identifies vacant areas for dispersing wolves, while the focus during breeding and whelping seasons maximizes control of hybrid production. See Knowlton (1972) for a discussion of the temporal effectiveness of coyote control and why control during the breeding season is effective.

The approach outlined above will simultaneously reduce known introgression, reduce zones of ignorance, provide data to test key hypotheses and allow for the determination of the RWAMP's overall effectiveness. The following predictions can be used to test and evaluate the plan:

P1: Red wolves are territorial to the exclusion of pairs or groups of coyotes.
P2: The number of known red wolf breeding units increases over time.
P3: The percent of coyote-free land occupied by red wolves increases over time.
P4: Number of known "breeding" pairs or groups (sterilized pairs, and red wolf pairs) increases asymptotically with time.
P5: The number of sterilized animals decreases over time.
P6: The number of mixed pairs that change to wolf pairs is greater than the number of wolf pairs that change to mixed pairs.
P7: The fraction of the known reproduction (red wolf and hybrid) that is hybrid decreases overtime.
P8: The percent hybrid litters is on a trajectory to a value that is consistent with maintaining 90% of the founding genetic diversity for 100 years (1-2% of the red wolf reproduction is hybrid).

Statistically, testing some of these predictions may be problematic. Many are cast as time series data and a lack of independence of observations or pseudo-replication may be an issue, especially for analysis of variance and linear regression techniques. However, many can be cast as null models that should enhance their test-ability. Nonetheless, the most appropriate means by which these predictions are tested is evolving over time with guidance from the RWRIT. Table 1 below summarizes the current status regarding available data and future needs regarding these hypotheses.

Table 1. Red wolf adaptive management plan predictions and data needs.

Prediction	Data Currently being collected?	If No, Does Plan Address?
P1*	No	Yes, n>10 locations/animal/season
P2	Yes, baseline established	
P3*	No	Yes, n>10 locations/animal/season
P4	Yes, baseline established	
P5	Yes, baseline established	
P6	Yes	
P7	Yes	
P8	Yes	

* P1 and P3 are critical in validating the underlying tenet of this plan - that space is limiting and red wolves will exclude coyotes. Data with regard to these predictions is critical to assess the feasibility of managing hybridization, and thus whether red wolves can coexist with eastern coyotes. These predictions are not being tested because few coyotes are monitored in areas of wolf establishment.

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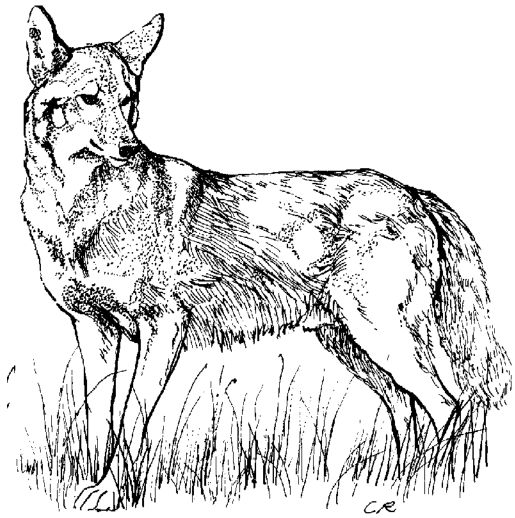
Red Wolf Adaptive Management Plan FY10-FY12



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PREFACE

The Red Wolf Adaptive Management Plan (RWAMP) specifies the framework and general goals of an adaptive plan by which the feasibility of controlling hybridization between red wolves (*Canis rufus*) and eastern coyotes (*C. latrans* var.) will be assessed while efforts to restore red wolves to northeastern North Carolina (NENC) continue. The RWAMP specifies core components designed to meet annual goals. However, the RWAMP retains the flexibility to adapt to new findings, either from the analysis of the data collected during implementation or from the findings of modeling efforts of research partners (see below I, II and III), or both. From this framework, the data it is designed to collect, and the modeling efforts and sensitivity analysis currently underway, the Red Wolf Recovery Program (RWRP) will be able to assess the RWAMP's progress and make recommendations regarding adaptions (changes), as necessary.

PURPOSE AND BACKGROUND

The purpose of the RWAMP is to specify the goals and an implementation strategy using an adaptive framework to assess, control, and manage hybridization occurring between red wolves and eastern coyotes in the only extant population of red wolves in the United States. The U.S. Fish and Wildlife Service (Service) began restoring red wolves to the wild in 1987. Red wolves had been declared biologically extinct in the wild in 1980. The history of the red wolf reintroduction efforts prior to the temporal scope of the RWAMP is well documented (Gilbreath, 1998; Phillips et al., 1995, 2003).

During the week of April 12, 1999, at the request of the Service, a 3.5 day facilitated workshop was conducted by the Conservation Breeding Specialist Group (CBSG) of the IUCN's Species Survival Commission. The purpose of the workshop was to gather together experts who had studied wolves and coyotes, and that had expertise and experience in genetics, modeling, and canid population biology to discuss the biological and ecological issues facing red wolf recovery. Four subject areas were identified to be the focus of the workshop: (1) red wolf population monitoring; (2) red wolf hybridization with coyotes; (3) selection of additional release sites; and, (4) the role of the captive breeding program.

After reviewing data on the reproduction of red wolves in the wild, the attendees of this workshop concluded that the proportion of hybrid litters from red wolf/coyote interbreeding was alarmingly high, and recommended that the workshop focus solely on issues surrounding red

wolf/coyote hybridization, including: (1) how much hybridization could occur in the population in northeastern North Carolina (NENC) while still maintaining its genetic integrity; (2) how to assess the degree of hybridization in the population; and, (3) how to limit hybridization to acceptable levels on a landscape scale. The RWAMP details an adaptive management approach (Holling, 1978; Walters, 1986) to these issues that is based on the recommendations from the CBSG workshop (Kelly et al.,1999).

ORGANIZATION OF THIS DOCUMENT

The RWAMP is organized into three sections: (I) an overview of the adaptive management paradigm and a discussion of how the RWAMP is consistent with this paradigm; (II) a description of the experimental approach of the RWAMP; and, (III) goals of the RWAMP and measures by which adaptions should be based.

(I) Adaptive Resource Management and the Red Wolf Recovery Program

Adaptive resource management (ARM) is an approach derived from the need to blend research and management. To be effective resource stewards, wildlife managers should refrain from conducting research and management independently. Instead, sound scientific principles should be applied to solve problems. Adaptive management provides the paradigm by which this can be accomplished (Lancia et al., 1996).

Adaptive management is characterized by a 4-step process (Walters, 1986): (1) reach a consensus among stakeholders; (2) analyze existing data and model preliminary predictions regarding various management schemes; (3) assess how sensitive predictions are to changes in various assumptions and variables; and, (4) implement management in an experimental context. Adaptation of a management plan is effected via feedback from experimental results generated in step. Because the RWRP was seen as being in a crisis stage by the participants of the CBSG workshop, the RWRP did not adhere to the sequential implementation of this process. Instead, based on the results of the CBSG workshop (Kelly et al., 1999), several of the four steps outlined above were engaged simultaneously. Nonetheless, the Service's mission of working with others and basing decisions on sound science is consistent with the adaptive management paradigm and provided somewhat of a head-start on the four steps mentioned above. The current state of each step is detailed below.

Reach a Consensus among Stakeholders (1)

In the ideal ARM paradigm, all stakeholders concede something to implement an adaptive management plan. In the context of the RWRP, red wolves are listed as endangered throughout their range, but a population was reintroduced under the non-essential experimental designation available in section 10(j) of the Endangered Species Act (Act). This designation allows for exceptions to the provisions of the Act that prohibit the take of an endangered species, specifically as it applies to the non-essential population (NEP) of red wolves. So in a broad sense, advocates of wolf introduction and restoration conceded absolute protection of wolves to accomplish restoration; and, by having greater flexibility to take wolves, opponents to wolf restoration were more amenable to wolves on the land. The rule-making process associated with an NEP designation provides the forum for reaching consensus. This process typically involves public meetings and written comment periods that result in the revision of a proposed rule to reflect consensus. The RWRP followed such a process to derive its current management rule (60 Federal Register 18941). However, the advent of a serious threat to recovery from hybridization precipitated the need to change the current red wolf rule. Prior to initiating the rule changing process, the RWRP pro-actively conducted open houses in the local communities to inform stakeholders of the need to change the rule and described conceptually the RWAMP. Although the rule package has not yet been published for public comment, the open houses have functioned to inform and begin the process of generating consensus. Additionally, RWRP personnel continue to present and discuss strategies of the RWAMP opportunistically with landowners and other members of the public, particularly when management activities are conducted on private or non-federal lands.

Analyze Existing Data and Generate Models (2)

Prior to the CBSG workshop, no analysis had examined hybridization between red wolves and coyotes, and little empirical data existed on this topic. Participants of the CBSG workshop crafted a simple, theoretical, deterministic model of coyote genetic introgression into the NENC red wolf population. The model indicated that the restored red wolf population could sustain very little hybridization if it was to maintain its genetic identity. Because the model, the workshop recommendations, and therefore much of the RWAMP, were largely based on

theoretical information, the Service and partners initiated research projects to address the dearth of data and to construct more applicable models to guide management decisions and actions.

A genetic test to distinguish pure red wolves from hybrids and a more substantial model of coyote introgression were projects that were deemed requisites to controlling hybridization. As more information has been gathered, additional models of social interactions between sympatric red wolves and eastern coyotes, and red wolf survival analysis were undertaken.

Assess How Sensitive Predictions Are To Changes in Assumptions and Variables (3)

At the CBSG workshop, the need to assess the sensitivity of the models that would guide the RWAMP and future adaptations was evident. Field efforts would collect data on key variables or to test key assumptions, but collecting this data would not detract from affecting change in the population towards achieving recovery goals. The models would then be refined with empirical data from red wolves, eastern coyotes, and/or hybrids in the NENC population as these data became available and the models would serve to influence future management recommendations.

As an example of the sensitivity assessment of the introgression model, a recent modeling run was conducted where 75% of hybrids and mixed pairs were sterilized. This scenario had a large impact on the integrity of the red wolf genome with 30-year projections predicting greater than 90% retention. Simulation of simply removing hybrids was not nearly as effective. The introgression model to date would support the hypothesis that sterile hybrids are functioning as effective place holders, thereby reducing the rate of emigration of hybrids and potential introgression into the red wolf population.

Likewise, a red wolf/coyote/hybrid spatial use model is currently being developed, based on empirical results derived from the field component of the RWRP in NENC. Results from these analyses may identify variables or assumptions that significantly affect the management options best tailored for reducing red wolf-hybrid encounters and maximizing available space for red wolf colonization. Ideally, the introgression and spatial models will eventually be integrated to assess the overall impact of hybridization on a landscape scale and help determine the effectiveness of the RWAMP.

Implement Management in an Experimental Context (4)

See III below (Implementation of the RWAMP and Measures by Which Adaptions Should Be Based) for information on how the RWRP is implementing this component of the adaptive management paradigm.

(II) Goals of the Adaptive RWAMP and a Description of the Experimental Approach

The goals of the RWAMP are to (1) reduce interbreeding between red wolves and eastern coyotes to a level that does not threaten the long term genetic integrity of the red wolf in the wild while simultaneously (2) building and maintaining the wild red wolf population from east to west in the NENC recovery area (see Figures 1 and 2). Achievement of the first of these goals is approached by eliminating the breeding potential of eastern coyotes within the study area through removing some eastern coyotes immediately upon capture and by sterilizing, radio-collaring and releasing others. The adaptive approach allows for the second of the RWAMP's goals, namely increasing the red wolf population.

Man's inability to control coyotes is noteworthy (Lantz, 1905a; 1905b; Balser, 1974a; 197ab). Recall that wolves were rather easily exterminated from the U.S. during the predator control efforts of the early 20th century, while at the same time the range of the coyote increased. Decades of effort have been spent trying to remove coyotes to protect domestic livestock from predation. However, efforts to remove the offending individuals are often problematic and produce inconsistent results (Conner et al., 1998; Sacks et al., 1999b). Because coyotes are territorial and typically kill livestock to provision their pups (Till and Knowlton, 1983; Sacks et al., 1999a), researchers began testing whether surgically-sterilized but hormonally-intact coyotes could function to protect livestock by defending space against coyotes needing to provision pups (Bromley and Gese, 2001a; Bromley and Gese, 2001b). It is this concept of holding space that is being applied to manage hybridization by providing managers time, information, and a higher degree of control over the recovery landscape, while simultaneously providing reproductive advantage to the red wolf.

Eliminating "zones of ignorance" is the primary component of the management process to ensure that all intact (breeding) pairs are wolves. These "zones of ignorance" are areas where no known canid is present, or where a nomadic (Crabtree, 1988) or transient (Windberg and Knowlton, 1988) red wolf is present but its status is unknown. Sterilization of coyotes (and hybrids) not only achieves one of the goals of the RWAMP by limiting eastern coyote genomic

introgression, but it also provides a biological means by which zones of ignorance can be systematically assessed and eliminated, a critical intermediate step in the transition to a landscape occupied predominantly by red wolf breeding groups. Ultimately, sterilization is a method that allows territorial space to be held until that animal can be replaced naturally or by management actions.

The underlying tenet of this approach is that space, and therefore territories, is limited on the recovery peninsula. Given a small, introduced red wolf population, that space is initially best occupied by breeding pairs of red wolves, non-breeding mixed (red wolf/coyote) pairs, and non-breeding eastern coyote pairs. In this way, introgression of non-wolf genes will be controlled and territories will be unavailable for colonization by intact eastern coyote or mixed pairs. As the red wolf population grows, having space available to dispersing red wolves becomes increasingly important and this space is provided through natural interspecific behavior and/or management actions.

(III) Implementation of the RWAMP and Measures by Which Adaptions Should Be Based

The RWAMP is framed around the following biological seasons:

Months	Biological Season	Associated Field Work
October-March	Pair-bonding/Breeding	Trap red wolf groups to ID and radio collar, and address partial zones of ignorance
February-March	Breeding	Address partial zones of ignorance
April-May	Whelping	Den work; transponder and ID pups
June-September	Pup-rearing	Survey zones of ignorance

Goals, by season, and general methods of the RWAMP are presented below. These goals generally are implemented in a priority order from Zone 1 through Zone 3, according to the three zones identified during CBSG workshop (Figure 1) and later modified (Figure 2). An outline of goals and tasks follow:

1. October - January (Pre-breeding/Pair Bonding):

a. Confirm and monitor the identification and disposition of individuals within known red wolf groups.

   i. Capture and assess ID of wolves (pack members) not previously captured and/or identified. ID is determined by genetic analysis of blood samples, morphological measurements, and pedigree data.

   ii. Confirm the presence, via recapture or survey, of previously identified and radio-collared wolves that have disappeared. Surveys methods can include identification of tracks, scat, or images from remote cameras, as well as visual observations of the wolves. The presence of a breeder may be confirmed from genetic assessment of the pups at time of their capture.

   iii. Capture and radio collar pups identified and implanted with transponders at the den the previous whelping season, as needed.

b. Provide space for dispersing or inserted wolves.

   i. Remove sterile space-holders.

   ii. Identify associates of previously suspected lone wolves, and remove non-wolf canids (see 2.b.i-iii.)

c. Conduct insertions of wolves into areas previously occupied by eastern coyotes or hybrids. This time of year is preferred when inserting island-reared wolves. The use of wild wolves that have recently dispersed from their natal home range will be opportunistic.

d. Determine genomic identity of new associates of previously suspected lone wolves to prevent hybrid mating (i.e., address partial zones of ignorance).

   i. Capture and assess genomic identity and decide disposition of every animal caught while trapping for suspected associates.

   ii. Genomic identity is determined by genetic analysis of blood samples, morphological measurements, and pedigree data.

   iii. Use survey methods (see 1.a.ii.) to focus capture efforts and address zones of ignorance. Additional survey methods appropriate for this objective include siren surveys and public reports.

2. February-March (Breeding):

a. Continue with objective 1.a. through March 15th for areas not completed during the pre-breeding season.

b. Continue with objective 1.d. (address partial zones of ignorance)

c. When 2.a. and 2.b. are completed, focus can shift to addressing zones of ignorance.

d. Survey Zone 1 for presence of eastern coyotes or hybrids (e.g., scat surveys for genetic ID).

3. April-May (Whelping):

   a. Monitor all breeding-age canids (including sterilized individuals) to ascertain whether they exhibit localized movements.

      i. If non-wolf females or female associates of non-wolf males localize movement, efforts should be made to determine whether she has a litter, and, if so, it should be removed.

      ii. If red wolf females localize movements, try to locate the den beginning one week after the suspected whelping date. Blood samples should be taken from each pup for genetic analysis, and transponders inserted. Litters identified as non-wolf following genetic analysis should be removed.

   b. Selectively cross-foster red wolf pups or litters from wild or captive litters.

   c. Continue with objective 2.c. if not yet complete.

4. June-September (Pup-rearing): Continue surveying zones of ignorance.

5. Year-round efforts; to the extent possible:

   a. Locate each radio-collared red wolf, via ground and aerial telemetry and/or by using satellite or GPS collars, a minimum of 10 or more usable locations sampled per biological season.

   b. Gather data relevant to assessing dispersal patterns of red wolves, eastern coyotes, and red wolf-coyote hybrids.

c. Gather data essential to assess demographic parameters of the red wolf population necessary to assess viability of the red wolf population.

Seasonal variation in behavior dictates the timing for implementation of these goals. Focusing on known breeding groups of wolves during the pre-breeding season not only insures the ability to capture and begin tracking wolves that will serve as dispersers into the population, but also avoids exposing known red wolf groups to activities (e.g., trapping and handling) during the breeding season that may compromise their ability to breed and produce a litter. In contrast, the focus on zones of ignorance during pre-breeding identifies vacant areas for dispersing wolves, while the focus during breeding and whelping seasons maximizes control of hybrid production. See Knowlton (1972) for a discussion of the temporal effectiveness of coyote control and why control during the breeding season is effective.

The approach outlined above will simultaneously reduce known introgression, reduce zones of ignorance, provide data to test key hypotheses, and allow for the determination of the RWAMP's overall effectiveness. The following predictions can be used to test and evaluate the RWAMP:

P1: Red wolves are territorial to the exclusion of pairs or groups of eastern coyotes.

P2: The number of known red wolf breeding units increases over time.

P3: The percent of coyote-free land occupied by red wolves increases over time.

P4: Number of known "breeding" pairs or groups (sterilized pairs, and red wolf pairs) increases asymptotically with time.

P5: The number of sterilized animals decreases over time.

P6: The number of mixed pairs that change to red wolf pairs is greater than the number of red wolf pairs that change to mixed pairs.

P7: The fraction of the known reproduction (red wolf and hybrid) that is hybrid decreases overtime.

P8: The percent hybrid litters is on a trajectory to a value that is consistent with maintaining 90% of the founding genetic diversity for 100 years (1-2% of the red wolf reproduction is hybrid).

Statistically, testing some of these predictions may be problematic. Many are cast as time

series data and a lack of independence of observations or pseudo-replication may be an issue, especially for analysis of variance and linear regression techniques. However, many can be cast as null models that should enhance their test-ability. Nonetheless, the most appropriate means by which these predictions are tested is evolving over time with guidance from researchers and collaborators. Table 1 below summarizes the current status regarding available data and future needs regarding these hypotheses.

Table 1. RWAMP predictions and data needs.

Prediction	Data Currently being collected?	If No, Does RWAMP Address?
P1*	No	Yes, n>10 locations/animal/season
P2	Yes, baseline established	
P3*	No	Yes, n>10 locations/animal/season
P4	Yes, baseline established	
P5	Yes, baseline established	
P6	Yes	
P7	Yes	
P8	Yes	

* P1 and P3 are critical in validating the underlying tenet of the RWAMP - that space is limiting and red wolves will exclude eastern coyotes. Data with regard to these predictions is critical to assess the feasibility of managing hybridization, and thus whether red wolves can coexist with eastern coyotes. These predictions are not being tested because few eastern coyotes are monitored in areas of red wolf establishment.

Figure 1. Map of the NENC red wolf recovery area showing CBSG identified management zones.

Figure 2. Map of the NENC red wolf recovery area showing the modified management zones.

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Red Wolf Recovery Program

Photo credit: Greg Koch

2nd Quarter Report

January - March 2010

Coordinator: David R. Rabon Jr., PhD
Wildlife Biologists: Art Beyer, Chris Lucash, Ford Mauney, Michael L. Morse
Biological Technician: Ryan Nordsven
Outreach Coordinator: Vacant
Administrative Assistant: Vacant
Intern (Caretaker): David J. Sharp

www.fws.gov/redwolf

trackthepack.blogspot.com

The Red Wolf Recovery Program

The red wolf (*Canis rufus*) is one of the most endangered canids in the world. Once occurring throughout the eastern and south-central United States, red wolves were decimated by predator-control programs and the loss and alteration of habitats. By the 1970s, these activities had reduced the red wolf population to a small area along the Gulf coast of Texas and Louisiana. To protect the species from extinction, the U.S. Fish and Wildlife Service initiated efforts to locate and capture as many red wolves as possible for the purposes of establishing a program to breed the species in captivity and one day reintroduce the species into a portion of its former range. More than 400 canids were captured in coastal areas of Texas and Louisiana, but only 17 were identified as red wolves. Fourteen of these wolves would become the founding members of the captive-breeding program and the ancestors of all red wolves existing today.

The first litter of red wolves born in captivity occurred in 1977. Within a few years red wolves were successfully reproducing in captivity, allowing the U.S. Fish and Wildlife Service to consider reintroducing the species in the wild. In 1987, four male-female pairs of red wolves were released in Alligator River National Wildlife Refuge (ARNWR) in northeastern North Carolina and designated as an experimental population. Since then, the experimental population has grown and the recovery area expanded to include four national wildlife refuges, a Department of Defense bombing range, state-owned lands, and private lands, encompassing about 1.7 million acres. However, interbreeding with the coyote (a species not native to North Carolina) has been recognized as a threat affecting the restoration of red wolves. Currently, adaptive management efforts are making progress in reducing the threat of coyotes to the red wolf population in northeastern North Carolina. Other threats, such as habitat fragmentation, disease, and premature mortality, are of concern in the restoration of red wolves. Efforts to reduce the threats are presently being explored.

Program Objectives

The current recovery plan (U.S. Fish and Wildlife Service, 1990) specifies the following objectives:

1) Establish and maintain at least three red wolf populations via restoration projects within the historic range of the red wolf. Each population should be numerically large enough to have the potential for allowing natural evolutionary processes to work within the species. This must be paralleled by the cooperation and assistance of at least 30 captive-breeding facilities in the United States.
2) Preserve 80% to 90% of red wolf genetic diversity for 150 years.
3) Remove threats of extinction by achieving a wild population of approximately 220 wolves and a captive population of approximately 330 wolves.
4) Maintain the red wolf into perpetuity through embryo banking and cryogenic preservation of sperm.

The Red Wolf Population

For the purposes of this report, all population figures are comprised only of known canids (i.e., wolves, coyotes, and/or hybrids that are actively monitored through either a functioning radio-collar or surgically implanted abdominal radio transmitter). Additional wolves, coyotes, and/or hybrids may be present, but have not been captured or their presence otherwise confirmed.

Population and Territory Status

A total of 78 known red wolves occupied the Red Wolf Recovery Area (i.e., 1.7 million acres in five counties in northeastern North Carolina) at the end of the second quarter of our fiscal year 2010 (FY 10). The population includes 29 packs (totaling 67 wolves) with 14 breeding pairs. An additional 11 wolves are not known to be associated with a pack (as defined in the Pack Summaries section).

Wolf Pairings

Three new wolf pairs (Gator pack, Weyerhaeuser pack, Bishop pack) were formed and one wolf pair (L-Block pack) separated, giving the Recovery Program a net gain of two new breeding pairs during the quarter. The male and female wolves placed in a soft-release acclimation pen in December 2009 in an attempt to form a breeding pair (Little Alligator pack) were released in January 2010. The male wolf remained in the area following release, but the female returned to her natal territory. To date, no other female wolf has moved into the area.

Wolf Captures and Radio Telemetry Marking

During this quarter, Red Wolf Recovery Program staff logged approximately 4,498 trap-nights. For that effort, 37 wolves were captured, 13 of which were first time captures. All wolves were fitted or re-fitted with radio-collars (either VHF or GPS) and released, except for one adult female that is currently held in captivity for veterinary care. Captured wolves consisted of 22 males and 15 females; 13 adults (> 2 years of age), 10 yearlings (1-2 years of age), and 14 pups (< 1 year of age).

Dispersals

Nine known wolves (7 males, 2 females) dispersed from their natal territories, including one adult, seven yearlings, and one pup.

Mortalities

Two known wolves (1 adult male, 1 female pup) from the Red Wolf Recovery Area died during the quarter. The adult male wolf died from intra-specific aggression after being displaced from his territory and exhibiting wide-ranging movements. The female pup was killed by gunshot; the carcass was transferred to the National Wildlife Health Center (Madison, WI) for necropsy, and the incident was reported to the U.S. Fish and Wildlife Service's Office of Law Enforcement.

Disappearances

The Red Wolf Recovery Program lost radio contact with three wolves (3 males; 1 adult, 1 yearling, 1 pup) during the quarter. The adult male wolf (Shirley pack) disappeared after losing his mate (Fall 2009) to an unknown cause of death. The yearling male (Tyson pack) disappeared after dispersing from his natal territory. The male pup (Rich pack) disappeared after dispersing from his natal territory when a non-resident male wolf moved in.

Pack Summaries

For the purposes of this report, the criteria used to define a pack include a known wolf maintaining an established territory and is either associating with or has historically associated with another wild canid inhabiting the same territory. Packs identified in the following summaries include a minimum of one known wolf within the quarter being reported.

Milltail Pack (4 collared wolves)

The Milltail pack consists of the radio-collared adult breeding pair (1544M male, 1357F female), one radio-collared yearling born in 2008 (1660F), and one radio-collared pup born in 2009 (1743F). These four wolves, along with three 2008 yearlings (1661M, 1662F, 1663M) and one 2009 pup (1745M), were captured, fitted or re-fitted with radio collars, and released in January 2010. Since their capture, 1661M, 1662F, 1663M, and 1745M have dispersed and are no longer considered part of the pack.

Gator Pack (2 collared wolves)

The Gator pack consists of a radio-collared adult breeding pair (1661M, 1085F). The yearling male wolf dispersed from the Milltail pack in February, joining the adult female wolf that occupied this territory.

Lux Pack (1 collared wolf)

The Lux pack consists of one radio-collared adult female wolf (904F). She recently moved into the territory following the death of the resident female wolf (1541F) in December 2009. No male canid has been captured at Lux pack.

Hester Pack (1 collared wolf, 1 collared coyote)

The Hester pack consists of one radio-collared male wolf (1333M) and one radio-collared sterile female coyote.

Waupaupin Pack (2 collared wolves)

The Waupaupin pack consists of a radio-collared adult breeding pair (1657M, 1471F). Two pups from the Waupaupin pack (1754F, 1757M) born in 2009 to the previous breeding male (1313M) and breeding female (1471F) were captured in February after having dispersed. They were radio-collared and released.

Ventures Pack (6 collared wolves)

The Ventures pack consists of the radio-collared adult breeding pair (1185M, 1207F), two radio-collared yearlings (1705M and 1706F) born in 2008, and two radio-collared (1777M, 1778F) pups born in 2009. The pups were captured, collared, and released in January.

Carmur Pack (1 collared wolf)

The Carmur Pack (formerly known as Boundary pack) consists of one radio-collared male wolf (1313M). The male wolf moved into the area following the death and disappearance of the previous wolf pair last quarter.

Swindell Pack (4 collared wolves)

The Swindell pack consists of the radio-collared adult breeding pair (1540M, 1419F) and two radio-collared pups (1749M, 1750M) born in 2009. The breeding male and the two pups were captured, collared or re-collared, and released in January. A radio-collared yearling (1684M) dispersed from the pack in January, becoming the new breeding male of Weyerhaeuser pack.

Weyerhaeuser Pack (2 collared wolf)

The Weyerhaeuser pack consists of a radio-collared adult breeding pair (1684M, 1440F). The male wolf dispersed from the Swindell pack in January.

Cameron Pack (1 collared wolf, 1 collared coyote)

The Cameron pack consists of a radio-collared adult male wolf (1726M) and a sterile radio-collared female coyote. The male wolf was captured, re-fitted with a radio collar, and released in February. The female coyote also was captured, sterilized, collared, and released in February.

Whitetail Pack (5 collared wolves)

The Whitetail pack (formerly known as ICW pack) consists of the radio-collared breeding female (1298F), one radio-collared yearling (1708F) born in 2008, and three radio-collared pups (1779F, 1780M, 1781M) born in 2009. The yearling and pups were captured, fitted-or re-fitted with radio collars, and released in February. A breeding male wolf is likely present, but has not been captured to date.

Kilkenny Pack (4 collared wolves)

The Kilkenny pack consists of a radio-collared breeding pair (1547M, 1170F) and two radio-collared pups (1766M, 1768M) born in 2009. The breeding male and the two pups were captured, fitted or re-fitted with radio collars, and released in February.

Rich Pack (3 collared wolves)

The Rich pack consists of a radio-collared breeding pair (1703M, 1633F) and one radio-collared pup (1741F) born in 2009. A radio-collared pup (1774M) dispersed from the pack in January, but his signal was lost in February; his fate remains unknown.

Pocosin Lakes Pack (3 collared wolves)

The Pocosin Lakes pack consists of a radio-collared breeding pair (1301M, 1358F) and one radio-collared pup (1748M) born in 2009. The pup was captured, collared, and released in March.

Pungo Pack (1 collared wolf)

The Pungo pack consists of a radio-collared male wolf (1620M). He was captured, fitted with a new radio collar, and released in February. A female coyote was captured and removed in March.

Beech Ridge Pack (3 collared wolves)

The Beech Ridge pack consists of three radio-collared siblings; an adult female (1429F) and two yearlings (1693F, 1698M). All were captured, re-fitted with radio collars, and released in January.

Bishop Pack (2 collared wolves)

The Bishop pack consists of a radio-collared breeding pair (1621M, 1671F). This is a newly discovered breeding pair. The male was lost to contact after his radio collar malfunctioned. When captured, fitted with a new radio collar, and released in February, it was determined that he was paired with the female wolf (1671F).

Shirley Pack (0 collared canids)

Radio contact was lost with the adult male wolf (1504M) of Shirley pack in February. His fate is unknown.

Mannings Pack (1 collared wolf)

The Mannings pack consists of a radio-collared male (1469M). He was captured, fitted with a new collar, and released in February. A female coyote was captured and removed from the area in March.

L-Block Pack (1 collared wolf)

The L-Block pack consists of a radio-collared adult male wolf (1238M). The radio-collared female wolf (1539F) left the L-Block pack and was captured near PLNWR in February. She is currently being held in captivity for medical treatment. The male was captured, fitted with a new collar, and released in March.

F2 Pack (1 collared wolf, 1 collared coyote)

The F2 pack consists of a radio-collared female wolf (1577F) and a sterile radio-collared male coyote. The male coyote moved into the area during the quarter.

Scuppernong Pack (1 collared wolf, 1 collared coyote)

The Scuppernong pack consists of a radio-collared male wolf (1683M) and a sterile radio-collared female coyote.

Tyson Pack (5 collared wolves)

The Tyson pack consists of the radio-collared breeding pair (1519M, 1448F), one radio-collared yearling (1682M), and two radio-collared pups (1760M, 1761M). A yearling female (1678F) dispersed from the area in January and became the new breeding female at Buck Ridge pack. A yearling male (1681M) also dispersed from the pack in January, but radio contact has since been lost. A female pup (1758F) was killed by gunshot in February.

Northern Pack (2 collared wolves)

The Northern pack consists of a radio-collared breeding pair (1628M, 1470F).

Gumneck Pack (2 collared wolves)

The Gumneck pack consists of a radio-collared breeding pair (1516M, 1685F). The female wolf was captured, fitted with a new radio collar, and released in February.

Buck Ridge Pack (1 collared wolf, 1 collared coyote)

The Buck Ridge pack consists of a radio-collared female wolf (1678F) and a sterile radio-collared male coyote. The female wolf settled the Buck Ridge area after dispersing from Tyson pack in January. The male coyote was captured, sterilized, collared, and released in February.

Frying Pan Pack (3 collared wolves)

The Frying Pan pack consists of the radio-collared breeding male (1177M) and two radio-collared offspring (1686F, a yearling female, and 1772F, a female pup). A third offspring, a radio-collared male (1533M), dispersed from the pack in January. He was captured north of Pungo Lake, fitted with a new collar, and released in March. The female yearling (1686F) was captured and released in February.

Timberlake Pack (2 collared wolves)

The Timberlake pack consists of a radio-collared breeding pair (1452M, 1300F).

Columbia Pack (2 collared wolves, 1 collared coyote)

The Columbia pack consists of a radio-collared male (1458M), his radio-collared female offspring (1630F), and a sterile radio-collared female coyote. The yearling female (1630F) returned to the area after being released from a soft-release acclimation pen at Little Alligator pack in an attempt to pair her with a male wolf (1727M).

Little Alligator Pack (1 collared wolf)

The Little Alligator pack consists of radio-collared yearling male (1727M). A coyote has been spotted with the male, but attempts to capture the coyote have been unsuccessful.

Collaborations

Research

The Red Wolf Recovery Program provided financial and in-kind support for collaborative research with scientists at other institutions, including universities, interagency divisions, and non-government research organizations. These investigations required project staff to assist outside researchers and graduate students in their efforts to better understand red wolf ecology, ecosystem function, and conservation efforts.

Project Title: Wild canid genetic sampling in Eastern North Carolina.
Graduate Student: Justin Bohling (PhD student)
Committee Chair/Principal Investigator: Lisette Waits, PhD, University of Idaho

Project Title: The effects of parenthood on red wolves (*Canis rufus*) in northeastern North Carolina.
Graduate Student: Justin Dellinger (MS student)
Committee Chair/Principal Investigator: Troy Best, PhD, Auburn University

Project Title: Identifying management procedures to reduce red wolf-coyote interactions in eastern North Carolina.
Graduate Student: Joseph Hinton (PhD student)
Committee Chair/Principal Investigator: Michael Chamberlain, PhD, Louisiana State University

Project Title: An assessment of spatial and temporal activities of wild adult male red wolves using GPS telemetry.
Graduate Student: Melissa Karlin (PhD student)
Committee Chair/Principal Investigator: John Chadwick, PhD, University of North Carolina at Charlotte

Project Title: Seasonal Cycles in Red Wolf Home Range Characteristics: A GPS Collar and Multispectral Satellite Image Study.
Graduate Student: Melissa Karlin (PhD student)
Committee Chair/Principal Investigator: John Chadwick, PhD, University of North Carolina at Charlotte

Project Title: Assessment of spatial and temporal activities of red wolves using GPS and VHF telemetry data.
Graduate Student: Melissa Karlin (PhD student)
Committee Chair/Principal Investigator: John Chadwick, PhD, University of North Carolina at Charlotte

Project Title: Dietary overlap between red wolves (*Canis rufus*) and coyotes (*Canis latrans*) in Eastern North Carolina.
Graduate Student: Justin McVey (MS student)
Committee Chair/Principal Investigator: Chris Moorman, PhD, North Carolina State University

Project Title: Evaluating potential effects of widening US Highway 64 on red wolves, Washington, Tyrrell, and Dare Counties, North Carolina.
Graduate Student: Christine Proctor (PhD student)
Committee Chair/Principal Investigator: Michael R. Vaughan, PhD, Virginia Polytechnic Institute and State University (Virginia Tech)

Publications

The following publications have gone to print in this quarter. A complete list of publications related to red wolves can be found at http://www.fws.gov/redwolf/biblio.html.

Grooms, S. 2010. Return to the wild: the cliffhanger story of the red wolf recovery. Wolf Print Magazine 39 (Spring):24.

Hinton, J.W., and M.J. Chamberlain. 2010. Space and habitat use by a red wolf pack and their pups during pup-rearing. Journal of Wildlife Management 74(1):55-58.

Mayer, K.O. 2010. Song of the wild: tracking the red wolf. DeSoto Magazine 6(10):36-41. [Available on-line at http://desoto.foliosnap.com]

Rabon, D.R., Jr., and W. Waddell. 2010. Effects of inbreeding on reproductive success, performance, litter size, and survival in captive red wolves (*Canis rufus*). Zoo Biology 29(1):36-49.

Presentations

The following presentations related to red wolves were given during this quarter.

Parker, W. 2010. The beginnings of the red wolf recovery project. Western North Carolina Nature Center. February 6, Asheville, NC.

Staff and Volunteers

The Red Wolf Recovery Program employs eight full-time staff, including the program coordinator, four wildlife biologists, a biological technician, an outreach coordinator, and an administrative assistant. The outreach coordinator and administrative assistant positions are currently vacant. The Red Wolf Recovery Program also benefits from an unpaid intern (Caretaker).

Outreach

Staff from the Red Wolf Recovery Program conduct presentations and attend events to inform and educate the public on the conservation needs of the red wolf and the restoration efforts of the Red Wolf Recovery Program. As part of our effort to assist educators, red wolf "discovery boxes" that include materials about the red wolf are distributed to educational facilities upon request.

The Red Wolf Recovery Program also seeks to achieve a quality visitor and participant experience in the U.S. Fish and Wildlife Service's priority recreational uses on National Wildlife Refuges. Our outreach efforts focus on four of the six program elements, including wildlife observation, wildlife photography, environmental education, and interpretation, and are conducted frequently in partnership with ARNWR and PLNWR educators and volunteers.

Presentations

Date	Location	Audience	Length	Attendance	Presenter
Feb 6	Hyde County	Hyde County Hunters (Youth Hunt Day)	4 hours	200+	C. Lucash F. Mauney M. Morse
March 5-7	Wake County	Dixie Deer Classic	3 days	24,000	M. Morse

Howlings

Date	Location	Event	Length	Attend	Presenter
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Website / Social Media

The Red Wolf Recovery Program recently launched a weblog to provide a fun and creative outlet that highlights the efforts of the Red Wolf Recovery Program staff in the conservation of the red wolf. The weblog will combine text, images, videos, and links to other media related to its topic. The content will include educational, informational, and general journal entries written by program staff, and will allow readers to leave comments in an interactive format. The weblog can be found at trackthepack.blogspot.com.

Partnerships

Species Survival Plan (SSP)

Species Survival Plan (SSP) captive facility coordination is based at Point Defiance Zoo & Aquarium (PDZA) in Tacoma, Washington. The SSP currently coordinates 42 captive red wolf sites at zoos and nature centers housing about 173 wolves [the number of wolves held in captivity was incorrectly reported in the FY10 1st Quarter Report. The correct number should have been 176 wolves.]. The following information is based on activities completed or conducted by the SSP Coordinator during the quarter reported. Additional information on the SSP can be found at www.fws.gov/redwolf or www.pdza.org.

The SSP Coordinator reported the completion and distribution of the 2009 Red Wolf International Studbook. The SSP Coordinator also noted that the new off-site facility located adjacent to Northwest Trek Wildlife Park is nearing completion, and anticipates having non-breeding red wolves moved to this site by the end of April 2010. Furthermore, an open house was held in March for the Clear Lake Homeowners Association (within howling distance of site) to tour the facility and to answer questions. About 20 individuals attended. Follow-up meetings are planned to keep residents informed. [The Northwest Trek facility will replace the existing Graham facility as the flagship captive-breeding facility at PDZA. The development of Northwest Trek was made possible, in part, with funds from the Omnibus Appropriations Act 2009 (Public Law 111-8 – March 11, 2009), and the efforts of Congressman Norm Dicks (WA) and Congressman Heath Shuler (NC). An additional $179,000 was awarded to the Western North Carolina Nature Center (Asheville, NC) to upgrade their red wolf breeding and holding facilities.]

The SSP Coordinator also reported that the North Carolina Museum of Life and Science in Durham, NC (NCMLS) provided the Red Wolf SSP with funds to accomplish two red wolf transfer recommendations. Based on last year's breeding and transfer recommendations, NCMLS was not scheduled to move any wolves, so they used their facility funds to assist other Red Wolf SSP partners. The Red Wolf SSP and the U.S. Fish and Wildlife Service extend their gratitude to NCMLS for their generous contribution to ensure these important transfers were achieved. In addition, two animal care staff from PDZA traveled to the red wolf recovery area in North Carolina to assist PhD student, Justin Bohling, University of Idaho, with scat collection for genetic sampling (see Research). Partial support for this research project, plus staff time and travel, was provided by PDZA Conservation Funds.

Island Propagation Sites

The U.S. Fish and Wildlife Service utilizes island sites to propagate red wolves and contribute to the restoration of a wild red wolf population, primarily by inserting island-born wolves into the wild population as a means to augment the wild red wolf gene pool with "under-represented" genes from the captive

population. Currently, the Red Wolf Recovery Program cooperates with St. Vincent National Wildlife Refuge in maintaining a breeding pair of red wolves on an island site.

Red Wolf Coalition

The Red Wolf Coalition (RWC) is a non-profit organization based in northeastern North Carolina that advocates for the long term survival of red wolf populations through education and outreach. The RWC's educational program teaches students about the history, biology, and status of the red wolf recovery program, and accompanies students to ARNWR and PLNWR to learn about the habitat of the red wolf. The RWC currently employees an Executive Director, and has a membership of approximately 400 individuals and organizations. The following information is based on activities completed or conducted by the Executive Director during the quarter reported. Additional information on the RWC can be found at www.redwolves.com.

The Executive Director of the RWC reported conducting five presentations to students from three state and two local-area schools, and responded to 16 requests for information on the red wolf. In addition, the RWC participated in an ecotourism workshop, hosted by East Carolina University and The Conservation Fund, on current ecotourism trends and opportunities.

Announcements

The Red Wolf Recovery Program recently lost a long-time friend and colleague. Curtis "Curt" J. Carley, the program's first Project Leader (now called Recovery Coordinator), passed away on April 6, 2010. Curt was hired to head the newly established program in Beaumont, Texas, in 1973, and continued to oversee the program after being transferred to the Regional Office in Albuquerque, NM. Curt retired after 31 years with the U.S. Fish and Wildlife Service in 1996. The Red Wolf Recovery Program extends their deepest sympathies to Sara (Curt's wife) and the Carley family. For additional information about Curt and his substantial contributions to the conservation of red wolves, please read his article entitled "The Red Wolf (*Canis rufus*) Recovery Program: Things they didn't tell me in school" (Carley, C. 2000. Reflections of a Naturalist: Papers honoring Professor Eugene D. Fleharty. Fort Hays Studies, Special Issue 1, pp. 125-141).

Red Wolf Recovery Program

Photo credit: Jeffrey Mittelstadt

1st Quarter Report (revised)

October - December 2011

Coordinator: David R. Rabon Jr., PhD
Wildlife Biologists: Art Beyer, Chris Lucash, Ford Mauney, Michael L. Morse
Biological Technician: Ryan Nordsven
Public Affairs and Outreach Coordinator: Vacant
Administrative Assistant: Vacant
Intern (Caretaker): Alayna McGarry
Albemarle Ecological Field Site (University of North Carolina at Chapel Hill) Intern: Ford Willis

www.fws.gov/redwolf

trackthepack.blogspot.com

www.facebook.com/redwolfrecoveryprogram

The Red Wolf Recovery Program

The red wolf (*Canis rufus*) is one of the most endangered canids in the world. Once occurring throughout the eastern and south-central United States, red wolves were decimated by predator-control programs and the loss and alteration of habitats. By the 1970s, these activities had reduced the red wolf population to a small area along the Gulf coast of Texas and Louisiana. To protect the species from extinction, the U.S. Fish and Wildlife Service initiated efforts to locate and capture as many red wolves as possible for the purposes of establishing a program to breed the species in captivity and one day reintroduce the species into a portion of its former range. More than 400 canids were captured in coastal areas of Texas and Louisiana, but only 17 were identified as pure red wolves. Fourteen of these wolves would become the founding members of the captive-breeding program and the ancestors of all red wolves existing today.

The first litter of red wolves born in captivity occurred in 1977. Within a few years red wolves were successfully reproducing in captivity, allowing the U.S. Fish and Wildlife Service to consider reintroducing the species in the wild. In 1987, four male-female pairs of red wolves were released in Alligator River National Wildlife Refuge (ARNWR) in northeastern North Carolina and designated as an experimental population. Since then, the experimental population has grown and the recovery area expanded to include four national wildlife refuges, a Department of Defense bombing range, state-owned lands, and private lands, encompassing about 1.7 million acres.

Adaptive Management

The recovery and restoration of red wolves requires the careful management of eastern coyotes (*C. latrans* var.) and occasionally wolf-coyote hybrids in the red wolf recovery area. The non-native coyotes spread across North Carolina to the red wolf recovery area in the early to mid-1990s. It soon was recognized that interbreeding between red wolves and eastern coyotes would produce hybrid offspring resulting in coyote gene introgression into the wild red wolf population, and that this introgression would threaten the restoration of red wolves. An adaptive management plan was developed to reduce interbreeding and introgression while simultaneously building the red wolf population. The adaptive management plan effectively uses techniques to capture and sterilize hormonally intact coyotes via vasectomy or tubal ligation, then releases the sterile canid at its place of capture to act as a territorial "placeholder" until the animal is replaced by wild red wolves. Sterile coyotes are not capable of breeding with other coyotes, effectively limiting the growth of the coyote population, nor are they capable of interbreeding with wild red wolves, limiting hybridization events. In addition, the sterile canid will exclude other coyotes from its territory. Ultimately, the placeholder canids are replaced by the larger red wolves either naturally by displacing the coyote or via management actions (e.g., removal of the coyote followed by insertion of wild or translocated wolves). Coyotes that are captured on private property are euthanized at the landowner's request.

Currently, adaptive management efforts are making progress in reducing the threat of coyotes to the red wolf population in northeastern North Carolina. Other threats, such as habitat fragmentation, disease, and anthropogenic mortality, also are of concern in the restoration of red wolves. Efforts to reduce these threats are presently being explored.

Program Objectives

The current recovery plan (U.S. Fish and Wildlife Service, 1990) specifies the following objectives:

1) Establish and maintain at least three red wolf populations via restoration projects within the historic range of the red wolf. Each population should be numerically large enough to have the potential for allowing natural evolutionary processes to work within the species. This must be paralleled by the cooperation and assistance of at least 30 captive-breeding facilities in the United States.
2) Preserve 80% to 90% of red wolf genetic diversity for 150 years.
3) Remove threats of extinction by achieving a wild population of approximately 220 wolves and a captive population of approximately 330 wolves.

4) Maintain the red wolf into perpetuity through embryo banking and cryogenic preservation of sperm.

The Red Wolf Population

We estimate between 90 and 110 red wolves in the Red Wolf Recovery Area, but for the purposes of this report all population figures are comprised only of known canids (i.e., those that are regularly monitored through either a functioning radio-collar or surgically implanted abdominal radio transmitter). Additional wolves are likely present, but have not been captured/radio-collared or their continued presence otherwise confirmed.

Beginning with the first quarter of the fiscal year 2012 (FY12) we have changed the way we report population and pack numbers. This change more accurately represents the managed population of canids that are part of our efforts to restore red wolves. The managed population includes wolf packs (i.e., packs consisting entirely of wolves) and mixed packs (i.e., packs of a wolf and coyote pair). A pack is defined as at least two known canids cooperatively inhabiting an established territory.

Population and Territory Status

A total of 66 known red wolves occupied the Red Wolf Recovery Area (i.e., 1.7 million acres in five counties in northeastern North Carolina) at the end of the first quarter of our fiscal year 2012 (FY 12). The population includes 16 wolf packs (comprised of 42 wolves and 11 breeding pairs), and five mixed packs (comprised of 5 wolves and 5 coyotes). An additional 19 wolves are not known to be associated with a pack. A total of 41 sterile coyotes were monitored in the Red Wolf Recovery Area at the end of this quarter.

Pairings

Two breeding pairs of red wolves were lost and two wolf pairs were formed during the quarter. Both breeding pair losses were the result of gunshot mortality to one member of the pair.

Two mixed pairs (wolf-coyote) were lost and one mixed pair formed during the quarter. One of the losses was the result of gunshot mortality of a sterile male coyote. The other loss was the result of displacement of a sterile female coyote by a female wolf.

Captures and Radio Telemetry Marking

Five red wolves were captured during the quarter, none of which were first-time captures. All wolves were fitted or re-fitted with radio-telemetry collars (VHF or GPS) or surgically implanted with abdominal radio transmitters, and released. Captured red wolves consisted of three males and two females; three adults (> 2 years of age) and two juveniles (1-2 years of age).

Nine coyotes were captured and released during the quarter, seven of which were first-time captures. The first-time captured coyotes were sterilized before being radio-collared and released. The other two coyotes were previously sterilized; their radio collars were replaced before release. Captured coyotes consisted of five males and four females.

Dispersals and Displacements

Two known juvenile wolves (1 male, 1 female) dispersed from their natal territories during the quarter.

Three sterile female coyotes were displaced from their respective territories by wolves during the quarter.

Mortalities

Nine wolves (6 males, 3 females) from the Red Wolf Recovery Area are known to have died during the quarter. Mortalities consisted of five adult wolves and four juveniles. Two of the deaths were the result of management actions that are defined as legal take, including one wolf that was taken in defense of property because it exhibited tolerance behavior. Seven of the deaths were the result of suspected illegal take and are currently under investigation by the U.S. Fish and Wildlife Service's Office of Law Enforcement.

Six sterile, radio-collared coyotes also were known to have died during the quarter. Four of the deaths were the result of gunshot. The cause of death could not be determined for two coyotes.

The first quarter corresponds with the rifle hunting season in eastern North Carolina.

Disappearances

The Red Wolf Recovery Program lost radio contact with a juvenile female wolf and three coyotes (1 male, 2 females) during the quarter.

Pack Summaries

The Pack Summaries *section has been indefinitely discontinued due to recent events and current circumstances involving the apparent illegal take of red wolves within the Red Wolf Recovery Area.*

Collaborations

Research

The Red Wolf Recovery Program provided financial and in-kind support for collaborative research with scientists at other institutions, including universities, interagency divisions, and non-government research organizations. These investigations required project staff to assist outside researchers and graduate students in their efforts to better understand red wolf ecology, ecosystem function, and conservation efforts.

Project Title: Inbreeding and mate choice in wild red wolves.
Graduate Student: Kristin Brzeski (PhD student)
Committee Chair/Principal Investigator: Sabrina Taylor, PhD, Louisiana State University

Project Title: Identifying management procedures to reduce red wolf-coyote interactions in eastern North Carolina.
Graduate Student: Joseph Hinton (PhD student)
Committee Chair/Principal Investigator: Michael Chamberlain, PhD, University of Georgia

Project Title: Use of stable isotope analysis to elucidate predation patterns of sympatric canids.
Graduate Student: Anne-Marie Hodge (MS student)
Committee Chair/Principal Investigator: Brian Arbogast, PhD, University of North Carolina at Wilmington

Project Title: Evaluating potential effects of widening US Highway 64 on red wolves, Washington, Tyrrell, and Dare Counties, North Carolina.
Graduate Student: Christine Proctor (PhD student)
Committee Chair/Principal Investigator: Michael R. Vaughan, PhD, Virginia Polytechnic Institute and State University (Virginia Tech)

Project Title: Sperm morphology and motility of the red wolf (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigators: Albrecht Schulte-Hostedde, PhD, Laurentian University, and Gabriela Mastromonaco, PhD, Toronto Zoo

Publications

The following publications have gone to print in this quarter. A complete list of publications related to red wolves can be found at http://www.fws.gov/redwolf/biblio.html.

Dellinger, J.A., B.L. Ortman, T.D. Steury, J. Bohling, and L.P. Waits. 2011. Food habits of red wolves during pup-rearing season. Southeastern Naturalist 10:731-740.

Karlin, M., and J. Chadwick. 2011. Red wolf natal dispersal characteristics: comparing periods of population increase and stability. Journal of Zoology [early publication online at http://onlinelibrary.wiley.com/doi/10.1111/j.1469-7998.2011.00876.x/abstract].

Mech, L.D. 2011. Non-genetic evidence for the eastern wolf. Northeastern Naturalist 18:521-526.

Schneider, J.N., and R.E. Anderson. 2011. Tonal vocalizations in the red wolf (*Canis rufus*): potential functions of nonlinear sound production. Journal of the Acoustical Society of America 130(4): 2275-2284.

Presentations

Brzeski, K.E., S. Taylor, M.J. Chamberlain, D.R. Rabon, Jr. 2011. Inbreeding in wild red wolves. Program. The Wildlife Society's 18th Annual Conference, November 5-10, Waikoloa, Hawaii.

Karlin, M., and J. Chadwick. 2011. Predicting red wolf and coyote/hybrid animal relative habitat suitability on the Albemarle Peninsula, NC, using a presence only species distribution model. Program. The Wildlife Society's 18th Annual Conference, November 5-10, Waikoloa, Hawaii.

Rabon, D.R., Jr. 2011. Reintroduction of the critically endangered red wolf (*Canis rufus*). The Giant Panda Reintroduction Workshop, October 26-27, Dujiangyan, China.

Staff and Volunteers

The Red Wolf Recovery Program employs eight full-time staff, including the program coordinator, four wildlife biologists, a biological technician, a public affairs/outreach coordinator, and an administrative assistant. The public affairs/outreach coordinator and administrative assistant positions are currently vacant. The Red Wolf Recovery Program also benefits from an unpaid intern (Caretaker).

Outreach

Staff from the Red Wolf Recovery Program conduct presentations and attend events to inform and educate the public on the conservation needs of the red wolf and the restoration efforts of the Red Wolf Recovery Program. As part of our effort to assist educators, red wolf "discovery boxes" that include materials about the red wolf are distributed to educational facilities. The distribution of discovery boxes is managed by the Red Wolf Coalition (see Partnerships). Requests for discovery boxes should be made to kwheeler@redwolves.com.

The Red Wolf Recovery Program also seeks to achieve a quality visitor and participant experience in the U.S. Fish and Wildlife Service's priority recreational uses on National Wildlife Refuges. Our outreach efforts focus on four of the six program elements, including wildlife observation, wildlife photography,

environmental education, and interpretation, and are conducted frequently in partnership with ARNWR and PLNWR educators and volunteers.

Presentations

Date	Location	Audience	Length	Attendance	Presenter
October 26	Dujiangyan, China	The Giant Panda Reintroduction Workshop	1 hr	~60	D. Rabon
October 26	Kitty Hawk, NC	Wild Fest	5 hrs	250	A. McGarry D.J. Sharp F. Willis

Howlings

Date	Location	Event	Length	Attend	Presenter
October 15	ARNWR	Wolf-Awareness	2 hrs	45	A. McGarry D.J. Sharp
October 29	ARNWR	Howl-o-ween	2 hrs	50	A. McGarry D.J. Sharp
November 9	ARNWR	Wings Over Water	2 hrs	27	A. McGarry D.J. Sharp
November 11	ARNWR	Wings Over Water	2 hrs	11	A. McGarry D.J. Sharp
December 10	ARNWR	Full Moon Howl	2 hrs	35	C. Heffley D.J. Sharp

Website / Social Media

Information on the red wolf and the Red Wolf Recovery Program can be found on our website at www.fws.gov/redwolf.

The Red Wolf Recovery Program also maintains several social media sites. Our Facebook page (www.facebook.com/redwolfrecoveryprogram) connects our program with “friends” from around the world and informs them of the conservation efforts of the Red Wolf Recovery Program. Using Twitter, the Red Wolf Recovery Program connects with our “followers” by providing real-time information about all things red wolf. Follow us on Twitter at www.twitter.com/redwolfrecovery. Users can view and download high resolution pictures related to red wolves and the Red Wolf Recovery Program on our Flickr page (www.flickr.com/photos/trackthepack). Lastly, discover, watch, and share videos on red wolves on our YouTube site (www.youtube.com/trackthepacktube).

The Red Wolf Recovery Program also has a weblog that highlights the efforts of the Red Wolf Recovery Program staff in the conservation of the red wolf. The weblog combines text, images, videos, and links to other media related to its topic. The content includes educational, informational, and general journal entries written by program staff, and allows readers to leave comments in an interactive format. The weblog can be found at trackthepack.blogspot.com.

Media Inquires

The Red Wolf Recovery Program responded to numerous media inquiries during this quarter, including science writer DeLene Beeland (www.delene.us), who is writing a book about red wolves, and Jeffrey Mittelstadt, a graduate student from the University of North Carolina at Chapel Hill's School of Journalism, who is producing a number of video and mixed-media projects on red wolf restoration.

Partnerships

Species Survival Plan (SSP)

Species Survival Plan (SSP) captive facility coordination is based at Point Defiance Zoo & Aquarium (PDZA) in Tacoma, Washington. The SSP currently coordinates 40 captive red wolf sites at zoos and nature centers housing about 178 wolves. The following information is based on activities completed or conducted by the SSP Coordinator during the quarter reported. Additional information on the SSP can be found at www.fws.gov/redwolf or www.pdza.org.

The SSP Coordinator reported numerous correspondence and communications regarding red wolves, including coordinating the transfer of wolves to accommodate SSP institutional requests and completing the application process to grant North Carolina State University SSP status to house captive red wolves. The SSP Coordinator also completed and distributed to cooperating SSP institutions the final breeding and transfer recommendations for the 2001-2012 breeding season.

The SSP Coordinator submitted an application for export permit to provide additional samples for study (Laurentian University and Toronto Metro Zoo) to evaluate the effects of inbreeding on several sperm morphology parameters. The SSP Coordinator also completed reproductive ultrasound examinations on 11 female wolves in conjunction with a study being conducted by Kadie Anderson, DVM, PDZA Intern Veterinarian, to evaluate the prevalence of cystic endometrial hyperplasia in a subset of the SSP population of red wolves.

Island Propagation Sites

The U.S. Fish and Wildlife Service utilizes island sites to propagate red wolves and contribute to the restoration of a wild red wolf population, primarily by inserting island-born wolves into the wild population as a means to augment the wild red wolf gene pool with "under-represented" genes from the captive population. Currently, the Red Wolf Recovery Program cooperates with St. Vincent National Wildlife Refuge in maintaining a breeding pair of red wolves on an island site.

Red Wolf Coalition

The Red Wolf Coalition (RWC), a non-profit education organization based in Columbia, NC, advocates for the long term survival of wild red wolf populations by teaching about red wolves and by engaging the public in red wolf conservation. The RWC's web site (www.redwolves.com) provides information about the history, biology, and ecology of red wolves, as well as news about red wolf restoration. The RWC gives red wolf programs to school groups, professional organizations, university students, and other groups. The RWC also conducts workshops for teachers and non-formal educators, including people seeking certification in environmental education.

The RWC has obtained the necessary funds from the U.S. Department of Agriculture's Rural Development and from a generous gift from the North Carolina Zoological Society to construct the red wolf viewing facility at PLNWR in Columbia, NC. The red wolf viewing facility will include the construction of several enclosures to house red wolves, including a natural environment enclosure designed to showcase red wolves to the visiting public. The RWC also received a cash prize in the Chase Community Giving Challenge. In addition, the RWC Executive Director reported that General Mills Corporation

(Minneapolis, MN) selected the RWC to be one of three non-profits to work with a team of the company's marketing experts on fundraising, branding, and expanding the reach and effectiveness of the organization.

The RWC Executive Director reported conducting several education programs during the quarter, including participating in the Scuppernong River Festival (Columbia, NC); hosting about 150 people of all ages at a two-night red wolf event at the North Carolina Museum of Life and Science (Durham, NC); giving a presentation about red wolves to 20 Columbia (NC) high school students; assisting a mentored high school student with her senior presentation on red wolves at the Plymouth Christmas Festival (Plymouth, NC); and, giving presentations about red wolves to two classes at Edenton High School (Edenton, NC).

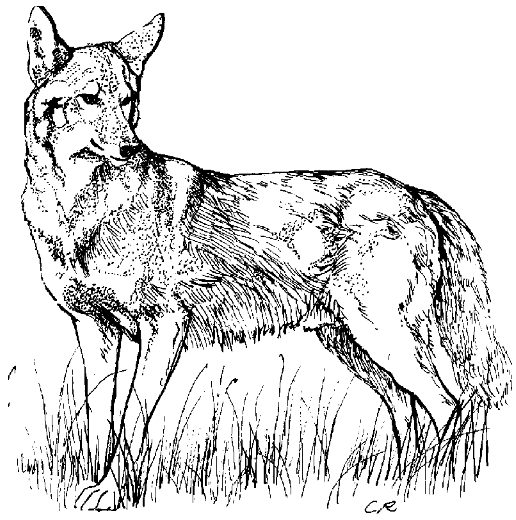
The RWC Executive Director and RWC Board of Directors chair (Neil Hutt) gave an all-day teacher workshop at the RWC office (Columbia, NC). Participants included public school teachers, environmental education certification candidates, and agency personnel. The next teacher workshop will be held on April 26, 2012, at the NC Museum of Life and Science (Durham, NC). Contact Kim Wheeler at 252-796-5600 or kwheeler@redwolves.com for information and details.

The RWC also has three Red Wolf Discovery Boxes for all grade levels. These boxes are filled with a variety of hands-on items, activities and artifacts that help students explore the world of red wolves. The red wolf curriculum *Far Traveler* and a variety of books and other resources also are included. Contact Kim Wheeler at 252-796-5600 or kwheeler@redwolves.com for more information or to reserve your Red Wolf Discovery Box.

Announcements

The U.S. Fish and Wildlife Service is investigating the suspected illegal take of several red wolves found dead in the Red Wolf Recovery Area (Dare, Hyde, Tyrrell, Washington, and Beaufort Counties, NC). Contributions from various organizations and individuals have resulted in a reward of up to $15,000 for information directly leading to an arrest, a criminal conviction, a civil penalty assessment, or forfeiture of property on the subject or subjects responsible for the suspected unlawful take of these red wolves. The red wolf is protected under the Endangered Species Act. The maximum criminal penalties for the unlawful taking of a red wolf are one year imprisonment and $100,000 fine per individual. Anyone with information on the deaths of red wolves is urged to contact Special Agent Sandra Allred at (919) 856-4786 or North Carolina Wildlife Resources Commission Officer Robert Wayne at (252) 216-8225.

Red Wolf Adaptive Management Plan FY13-FY15



Date Prepared:

February 2013

Revised by:

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PREFACE

The Red Wolf Adaptive Management Plan (RWAMP) specifies the framework and general goals in which the feasibility of controlling hybridization between red wolves (*Canis rufus*) and eastern coyotes (*C. latrans* var.) will be assessed while efforts to restore red wolves to northeastern North Carolina (NENC) continue. The RWAMP specifies core components designed to meet annual goals. However, the RWAMP retains the flexibility to adapt to new findings, either from the analysis of the data collected during implementation or from the findings of modeling efforts of research partners (see below I, II and III), or both. From this framework, the data it is designed to collect, and the modeling efforts and sensitivity analysis currently underway, the Red Wolf Recovery Program (RWRP) will be able to assess the RWAMP's progress and make recommendations regarding adaptions (changes), as necessary.

PURPOSE AND BACKGROUND

The purpose of the RWAMP is to specify the goals and an implementation strategy using an adaptive framework to assess, control, and manage hybridization occurring between red wolves and eastern coyotes in the only extant population of red wolves in the United States. The U.S. Fish and Wildlife Service (Service) began restoring red wolves to the wild in 1987. Red wolves had been declared biologically extinct in the wild in 1980. The history of the red wolf reintroduction efforts prior to the temporal scope of the RWAMP is well documented (Gilbreath, 1998; Phillips et al., 1995, 2003).

During the week of April 12, 1999, at the request of the Service, a 3.5 day facilitated workshop was conducted by the Conservation Breeding Specialist Group (CBSG) of the IUCN's Species Survival Commission. The purpose of the workshop was to gather together experts who had studied wolves and coyotes, and that had expertise and experience in genetics, modeling, and canid population biology to discuss the biological and ecological issues facing red wolf recovery. Four subject areas were identified to be the focus of the workshop: (1) red wolf population monitoring; (2) red wolf hybridization with coyotes; (3) selection of additional release sites; and, (4) the role of the captive breeding program.

After reviewing data on the reproduction of red wolves in the wild, the attendees of this workshop concluded that the proportion of hybrid litters from red wolf/coyote interbreeding was alarmingly high, and recommended that the workshop focus solely on issues surrounding red

wolf/coyote hybridization, including: (1) how much hybridization could occur in the NENC population while still maintaining its genetic integrity; (2) how to assess the degree of hybridization in the NENC population; and, (3) how to limit hybridization to acceptable levels on a landscape scale. The RWAMP details an adaptive management approach (Holling, 1978; Walters, 1986) to these issues that is based on the recommendations from the CBSG workshop (Kelly et al., 1999).

ORGANIZATION OF THIS DOCUMENT

The RWAMP is organized into three sections: (I) an overview of the adaptive management paradigm and a discussion of how the RWAMP is consistent with this paradigm; (II) a description of the experimental approach of the RWAMP; and, (III) goals of the RWAMP and measures by which adaptions should be based.

(I) Adaptive Resource Management and the Red Wolf Recovery Program

Adaptive resource management (ARM) is an approach derived from the need to blend research and management. To be effective resource stewards, wildlife managers should refrain from conducting research and management independently. Instead, sound scientific principles should be applied to solve problems. Adaptive management provides the paradigm by which this can be accomplished (Lancia et al., 1996).

Adaptive management is characterized by a 4-step process (Walters, 1986): (1) reach a consensus among stakeholders; (2) analyze existing data and model preliminary predictions regarding various management schemes; (3) assess how sensitive predictions are to changes in various assumptions and variables; and, (4) implement management in an experimental context. Adaptation of a management plan is effected via feedback from experimental results generated in step. Because the RWRP was seen as being in a crisis stage by the participants of the CBSG workshop, the RWRP did not adhere to the sequential implementation of this process. Instead, based on the results of the CBSG workshop (Kelly et al., 1999), several of the four steps outlined above were engaged simultaneously. Nonetheless, the Service's mission of working with others and basing decisions on sound science is consistent with the adaptive management paradigm and provided somewhat of a head-start on the four steps mentioned above. The current state of each step is detailed below.

Reach a Consensus among Stakeholders (1)

In the ideal ARM paradigm, all stakeholders concede something to implement an adaptive management plan. In the context of the RWRP, red wolves are listed as endangered throughout their range, but a population was reintroduced under the non-essential experimental designation available in section 10(j) of the Endangered Species Act (Act). This designation allows for exceptions to the provisions of the Act that prohibit the take of an endangered species, specifically as it applies to the non-essential population (NEP) of red wolves. So in a broad sense, advocates of wolf introduction and restoration conceded absolute protection of wolves to accomplish restoration; and, by having greater flexibility to take wolves, opponents to wolf restoration were more amenable to wolves on the land. The rule-making process associated with an NEP designation provides the forum for reaching consensus. This process typically involves public meetings and written comment periods that result in the revision of a proposed rule to reflect consensus. The RWRP followed such a process to derive its current management rule (60 Federal Register 18941). However, the advent of a serious threat to recovery from hybridization precipitated the need to change the current red wolf rule. Prior to initiating the rule changing process, the RWRP pro-actively conducted open houses in the local communities to inform stakeholders of the need to change the rule and described conceptually the RWAMP. Although the rule package has not yet been published for public comment, the open houses have functioned to inform and begin the process of generating consensus. Additionally, RWRP personnel continue to present and discuss strategies of the RWAMP opportunistically with landowners and other members of the public, particularly when management activities are conducted on private or non-federal lands.

Analyze Existing Data and Generate Models (2)

Prior to the CBSG workshop, no analysis had examined hybridization between red wolves and coyotes, and little empirical data existed on this topic. Participants of the CBSG workshop crafted a simple, theoretical, deterministic model of coyote genetic introgression into the NENC red wolf population. The model indicated that the restored red wolf population could sustain very little hybridization if it was to maintain its genetic identity. Because of the model, the workshop recommendations, and therefore much of the RWAMP, were largely based on

theoretical information, the Service and partners initiated research projects to address the dearth of data and to construct more applicable models to guide management decisions and actions.

A genetic test to distinguish pure red wolves from hybrids and a more substantial model of coyote introgression were projects that were deemed requisites to controlling hybridization. As more information has been gathered, additional models of social interactions between sympatric red wolves and eastern coyotes, and red wolf survival analysis were undertaken.

<u>Assess How Sensitive Predictions Are To Changes in Assumptions and Variables (3)</u>

At the CBSG workshop, the need to assess the sensitivity of the models that would guide the RWAMP and future adaptations was evident. Field efforts would collect data on key variables or to test key assumptions, but collecting this data would not detract from affecting change in the population towards achieving recovery goals. The models would then be refined with empirical data from red wolves, eastern coyotes, and/or hybrids in the NENC population as these data became available and the models would serve to influence future management recommendations.

As an example of the sensitivity assessment of the introgression model, models were conducted where 75% of hybrids and mixed pairs were sterilized (Hedrick, unpublished data). This scenario had a large impact on the integrity of the red wolf genome with 30-year projections predicting greater than 90% retention. Simulation of simply removing hybrids was not nearly as effective. The introgression model to date would support the hypothesis that sterile hybrids are functioning as effective place holders, thereby reducing the rate of emigration of hybrids and potential introgression into the red wolf population.

Likewise, a red wolf/coyote/hybrid spatial use model was developed, based on empirical results derived from the field component of the RWRP in NENC (Roth et al., 2008). Results showed the model was highly sensitive to the estimates of the competitive impact of coyotes on red wolves, through declines in wolf productivity. Simulations of coyote management from either removal or surgical sterilization detected that both management strategies increased viability of red wolf populations, especially during initial colonization. Results suggested that coyotes can inhibit red wolf reintroduction success through competitive interactions, but that management of coyote populations can improve the probability of successful wolf recovery (Roth et al., 2008).

Implement Management in an Experimental Context (4)

See III below (Implementation of the RWAMP and Measures by Which Adaptions Should Be Based) for information on how the RWRP is implementing this component of the adaptive management paradigm.

(II) Goals of the RWAMP and a Description of the Experimental Approach

The goals of the RWAMP are to: (1) reduce interbreeding between red wolves and eastern coyotes to a level that does not threaten the long term genetic integrity of the red wolf in the wild; and (2) build and maintain the wild red wolf population from east to west in the NENC recovery area (see Figures 1 and 2). Achievement of the first of these goals is approached by eliminating the breeding potential of eastern coyotes within the study area through removing some eastern coyotes immediately upon capture, and by sterilizing, fitting them with a radio-telemetry collar, and releasing others. The adaptive approach allows for the second of the RWAMP's goals, namely increasing the red wolf population.

Man's inability to control coyotes is noteworthy (Lantz, 1905a; Balser, 1974a; 1974b). While wolves were rather easily exterminated from the U.S. during the predator control efforts of the early 20th century, the range of the coyote increased. Despite widespread efforts to suppress coyote populations within their historical range, coyotes have quickly colonized most of North America (Nowak, 2002; Bekoff and Gese, 2002). Decades of effort have been spent trying to remove coyotes to protect domestic livestock from predation. However, efforts to remove the offending individuals are often problematic and produce inconsistent results (Conner et al., 1998; Sacks et al., 1999b; Mitchell et al. 2004; Connor et al. 2008). Because coyotes are territorial and typically kill livestock to provision their pups (Till and Knowlton, 1983; Sacks et al., 1999a), researchers began testing whether surgically-sterilized but hormonally-intact coyotes could function to protect livestock by defending space against coyotes needing to provision pups (Bromley and Gese, 2001a; 2001b; Seidler and Gese, 2012). It is this concept of holding space that is being applied to manage hybridization between red wolves and coyotes by providing managers time, information, and a higher degree of control over the recovery landscape, while simultaneously providing reproductive advantage to the red wolf.

Initially the NENC recovery area was considered uninhabited by coyotes; individuals

were not observed until the early 1990s (Phillips et al. 2003). As a result, a management plan was needed that considered the probable continued expansion of the coyote population within the recovery area in its attempt to eliminate the threat of hybridization (Kelly 2000). This incremental process required the recovery area to be segregated into specifically defined management zones, each managed to reduce risk reduction (Stoskopf et al., 2005). Eliminating "zones of ignorance" is the primary component of the management process to ensure that all intact (breeding) pairs are wolves. These "zones of ignorance" are areas where no known canid is present, or where a nomadic (Crabtree, 1988) or transient (Windberg and Knowlton, 1988) red wolf is present but its status is unknown. Sterilization of coyotes (and hybrids) not only achieves one of the goals of the RWAMP by limiting eastern coyote genomic introgression, but it also provides a biological means by which zones of ignorance can be systematically assessed and eliminated, a critical intermediate step in the transition to a landscape occupied predominantly by red wolf breeding groups. Ultimately, sterilization is a method that allows territorial space to be held until that animal can be replaced naturally or by management actions (Bromley and Gese, 2001b; Seidler and Gese, 2012).

The underlying tenet of this approach is that space, and therefore territories, is limited on the recovery peninsula. Given a small, reintroduced red wolf population, that space is initially best occupied by breeding pairs of red wolves, non-breeding mixed (red wolf/coyote) pairs, and non-breeding eastern coyote pairs. In this way, introgression of non-wolf genes will be controlled and territories will be unavailable for colonization by intact eastern coyote or mixed pairs. As the red wolf population grows, having space available for dispersing red wolves becomes increasingly important, and this space is provided through natural interspecific behavior and/or management actions.

(III) Implementation of the RWAMP and Measures by Which Adaptions Should Be Based

The RWAMP is framed around the following biological seasons:

Months	Biological Season	Associated Field Work
October-March	Pair-bonding/Breeding	Trap red wolf groups to ID and fit with a radio-telemetry collar, and address partial zones of ignorance

February-March	Breeding	Address partial zones of ignorance
April-May	Whelping	Den work; transponder and ID pups
June-September	Pup-rearing	Survey zones of ignorance

Goals, by season, and general methods of the RWAMP are presented below. These goals generally are implemented in a priority order from Zone 1 through Zone 3, according to the three zones identified during CBSG workshop (Figure 1) and later modified (Figure 2). An outline of goals and tasks follow:

1. October - January (Pre-breeding/Pair Bonding):
   a. Confirm and monitor the identification and disposition of individuals within known red wolf groups.
      i. Capture and assess ID of wolves (pack members) not previously captured and/or identified. ID is determined by genetic analysis of blood samples, morphological measurements, and pedigree data.
      ii. Confirm the presence, via recapture or survey, of previously identified and radio-telemetry collared wolves that have disappeared. Surveys methods can include identification of tracks, scat, or images from remote cameras, as well as visual observations of the wolves. The presence of a breeder may be confirmed from genetic assessment of the pups at time of their capture.
      iii. Capture and fit with a radio-telemetry collar pups identified and implanted with transponders at the den the previous whelping season, as needed.
   b. Provide space for dispersing or inserted wolves.
      i. Remove sterile space-holders.
      ii. Identify associates of previously suspected lone wolves, and remove non-wolf canids (see 2.b.i-iii.)
   c. Conduct insertions of wolves into areas previously occupied by eastern coyotes or hybrids. This time of year is preferred when inserting island-reared wolves. The use of wild wolves that have recently dispersed from their natal home range will be opportunistic.

d. Determine genomic identity of new associates of previously suspected lone wolves to prevent hybrid mating (i.e., address partial zones of ignorance).

   i. Capture and assess genomic identity and decide disposition of every animal caught while trapping for suspected associates.

   ii. Genomic identity is determined by genetic analysis of blood samples, morphological measurements, and pedigree data.

   iii. Use survey methods (see 1.a.ii.) to focus capture efforts and address zones of ignorance. Additional survey methods appropriate for this objective include siren surveys and public reports.

2. February-March (Breeding):

   a. Continue with objective 1.a. through March 15th for areas not completed during the pre-breeding season.

   b. Continue with objective 1.d. (address partial zones of ignorance)

   c. When 2.a. and 2.b. are completed, focus can shift to addressing zones of ignorance.

   d. Survey Zone 1 for presence of eastern coyotes or hybrids (e.g., scat surveys for genetic ID).

3. April-May (Whelping):

   a. Monitor all breeding-age canids (including sterilized individuals) to ascertain whether they exhibit localized movements.

      i. If non-wolf females or female associates of non-wolf males localize movement, efforts should be made to determine whether she has a litter, and, if so, it should be removed.

      ii. If red wolf females localize movements, try to locate the den beginning one week after the suspected whelping date. Blood samples should be taken from each pup for genetic analysis, and transponders inserted. Litters identified as non-wolf following genetic analysis should be removed.

   b. Selectively cross-foster red wolf pups or litters from wild or captive litters.

c. Continue with objective 2.c. if not yet complete.

4. June-September (Pup-rearing): Continue surveying zones of ignorance.

5. Year-round efforts; to the extent possible:
   a. Locate each radio-telemetry collared red wolf, via ground and aerial telemetry and/or by using satellite- or GPS-telemetry collars, a minimum of 10 or more usable locations sampled per biological season.
   b. Gather data relevant to assessing dispersal patterns of red wolves, eastern coyotes, and red wolf-coyote hybrids.
   c. Gather data essential to assess demographic parameters of the red wolf population necessary to assess viability of the red wolf population.

Seasonal variation in behavior dictates the timing for implementation of these goals. Focusing on known breeding groups of wolves during the pre-breeding season not only insures the ability to capture and begin tracking wolves that will serve as dispersers into the population, but also avoids exposing known red wolf groups to activities (e.g., trapping and handling) during the breeding season that may compromise their ability to breed and produce a litter. In contrast, the focus on zones of ignorance during pre-breeding identifies vacant areas for dispersing wolves, while the focus during breeding and whelping seasons maximizes control of hybrid production. See Knowlton (1972) for a discussion of the temporal effectiveness of coyote control and why control during the breeding season is effective.

The approach outlined above will simultaneously reduce known introgression, reduce zones of ignorance, provide data to test key hypotheses, and allow for the determination of the RWAMP's overall effectiveness. The following predictions can be used to test and evaluate the RWAMP:

P1: Red wolves are territorial to the exclusion of pairs or groups of eastern coyotes.

P2: The number of known red wolf breeding units increases over time.

P3: The percent of coyote-free land occupied by red wolves increases over time.

P4: Number of known "breeding" pairs or groups (sterilized pairs, and red wolf pairs) increases asymptotically with time.

P5: The number of sterilized animals needed decreases over time.

P6: The number of mixed pairs that change to red wolf pairs is greater than the number of red wolf pairs that change to mixed pairs.

P7: The fraction of the known reproduction (red wolf and hybrid) that is hybrid decreases overtime.

P8: The percent hybrid litters is on a trajectory to a value that is consistent with maintaining 90% of the founding genetic diversity for 100 years (1-2% of the red wolf reproduction is hybrid).

Statistically, testing some of these predictions may be problematic. Many are cast as time series data and a lack of independence of observations or pseudo-replication may be an issue, especially for analysis of variance and linear regression techniques. However, many can be cast as null models that should enhance their test-ability. Nonetheless, the most appropriate means by which these predictions are tested is evolving over time with guidance from researchers and collaborators. Table 1 below summarizes the current status regarding available data and future needs regarding these hypotheses.

Table 1. RWAMP predictions and data needs.

Prediction	Data Currently being collected?	If No, Does RWAMP Address?
P1*	No	Yes, n>10 locations/animal/season
P2	Yes, baseline established	
P3*	No	Yes, n>10 locations/animal/season
P4	Yes, baseline established	
P5	Yes, baseline established	
P6	Yes	
P7	Yes	
P8	Yes	

* P1 and P3 are critical in validating the underlying tenet of the RWAMP - that space is limiting and red wolves will exclude eastern coyotes. Data with regard to these predictions is critical to assess the feasibility of managing hybridization, and thus whether red wolves can coexist with eastern coyotes. These predictions are not being tested because few eastern coyotes are monitored in areas of red wolf establishment.

Figure 1. Map of the NENC red wolf recovery area showing CBSG identified management zones.

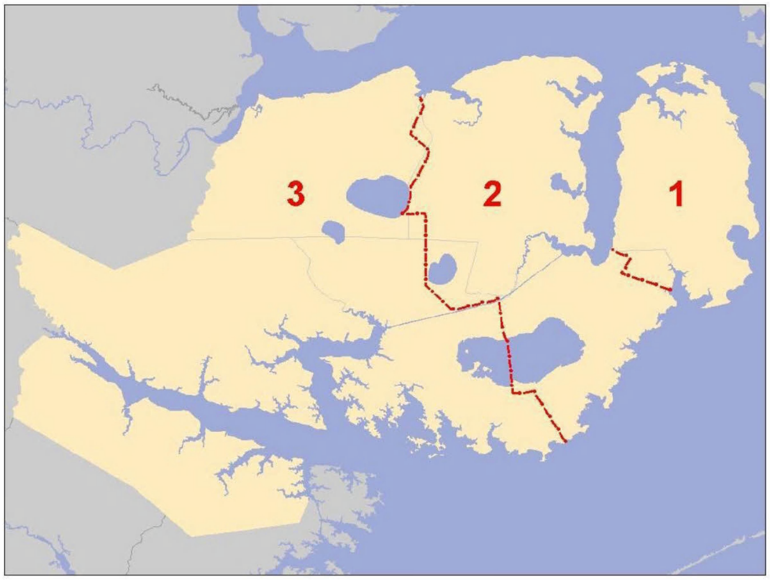
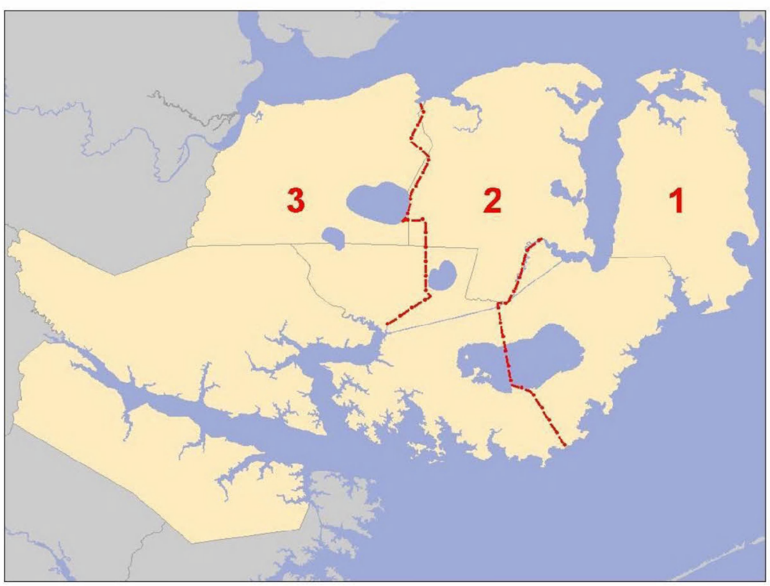


Figure 2. Map of the NENC red wolf recovery area showing the modified management zones.



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Red Wolf Recovery Program

Release of wild female red wolf, Pocosin Lakes National Wildlife Refuge
Photo credit: Becky Bartel/USFWS

2nd Quarter Report

January – March 2013

Coordinator: David R. Rabon Jr., PhD
Assistant Coordinator: Becky Bartel, PhD
Field Coordinator: Art Beyer
Wildlife Biologists: Chris Lucash, Ford Mauney, Michael L. Morse
Biological Technician: Ryan Nordsven
Administrative Assistant: Adam Fauth
Intern(s) (Caretaker): DJ Sharpe / Chelsea Vosburgh

www.fws.gov/redwolf

trackthepack.blogspot.com

www.facebook.com/redwolfrecoveryprogram

The Red Wolf Recovery Program

The red wolf (*Canis rufus*) is one of the most endangered canids in the world. Once occurring throughout the eastern and south-central United States, red wolves were decimated by predator-control programs and the loss and alteration of habitats. By the 1970s, these activities had reduced the red wolf population to a small area along the Gulf coast of Texas and Louisiana. To protect the species from extinction, the U.S. Fish and Wildlife Service initiated efforts to locate and capture as many red wolves as possible for the purposes of establishing a program to breed the species in captivity and one day reintroduce the species into a portion of its former range. More than 400 canids were captured in coastal areas of Texas and Louisiana, but only 17 were identified as pure red wolves. Fourteen of these wolves would become the founding members of the captive-breeding program and the ancestors of all red wolves existing today.

The first litter of red wolves born in captivity occurred in 1977. Within a few years red wolves were successfully reproducing in captivity, allowing the U.S. Fish and Wildlife Service to consider reintroducing the species in the wild. In 1987, four male-female pairs of red wolves were released in Alligator River National Wildlife Refuge (ARNWR) in northeastern North Carolina and designated as an experimental population. Since then, the experimental population has grown and the recovery area expanded to include four national wildlife refuges, a Department of Defense bombing range, state-owned lands, and private lands, encompassing about 1.7 million acres.

Adaptive Management

The recovery and restoration of red wolves requires the careful management of eastern coyotes (*C. latrans* var.) and occasionally wolf-coyote hybrids in the red wolf recovery area. The non-native coyotes spread across North Carolina to the red wolf recovery area in the early to mid-1990s. It soon was recognized that interbreeding between red wolves and eastern coyotes would produce hybrid offspring resulting in coyote gene introgression into the wild red wolf population, and that this introgression would threaten the restoration of red wolves. An adaptive management plan was developed to reduce interbreeding and introgression while simultaneously building the red wolf population. The adaptive management plan effectively uses techniques to capture and sterilize hormonally intact coyotes via vasectomy or tubal ligation, then releases the sterile canid at its place of capture to act as a territorial "placeholder" until the animal is replaced by wild red wolves. Sterile coyotes are not capable of breeding with other coyotes, effectively limiting the growth of the coyote population, nor are they capable of interbreeding with wild red wolves, limiting hybridization events. In addition, the sterile canid will exclude other coyotes from its territory. Ultimately, the placeholder canids are replaced by the larger red wolves either naturally by displacing the coyote or via management actions (e.g., removal of the coyote followed by insertion of wild or translocated wolves). Coyotes that are captured on private property are euthanized at the landowner's request.

Currently, adaptive management efforts are making progress in reducing the threat of coyotes to the red wolf population in northeastern North Carolina. Other threats, such as habitat fragmentation, disease, and anthropogenic mortality, also are of concern in the restoration of red wolves. Efforts to reduce these threats are presently being explored.

Program Objectives

The current recovery plan (U.S. Fish and Wildlife Service, 1990) specifies the following objectives:

1) Establish and maintain at least three red wolf populations via restoration projects within the historic range of the red wolf. Each population should be numerically large enough to have the potential for allowing natural evolutionary processes to work within the species. This must be paralleled by the cooperation and assistance of at least 30 captive-breeding facilities in the United States.
2) Preserve 80% to 90% of red wolf genetic diversity for 150 years.
3) Remove threats of extinction by achieving a wild population of approximately 220 wolves and a captive population of approximately 330 wolves.

4) Maintain the red wolf into perpetuity through embryo banking and cryogenic preservation of sperm.

Northeastern North Carolina Restored Population

We estimate between 90 and 110 red wolves in the Red Wolf Recovery Area, but for the purposes of this report all population figures are comprised only of known canids (i.e., those that are regularly monitored through either a functioning radio-collar or surgically implanted abdominal radio transmitter). Additional wolves are likely present, but have not been captured/radio-collared or their continued presence otherwise confirmed.

Beginning with the first quarter of the fiscal year 2012 (FY12) we have changed the way we report population and pack numbers. This change more accurately represents the managed population of canids that are part of our efforts to restore red wolves. The managed population includes wolf packs (i.e., packs consisting entirely of wolves) and mixed packs (i.e., packs of a wolf and sterile coyote pair). A pack is defined as at least two known canids cooperatively inhabiting an established territory.

Population and Territory Status

A total of 70 known red wolves occupied the Red Wolf Recovery Area (i.e., 1.7 million acres in five counties in northeastern North Carolina) at the end of the second quarter of our fiscal year 2013. The population includes 14 wolf packs (comprised of 46 wolves and 12 breeding pairs), and 10 mixed packs (comprised of 11 wolves and 10 sterile coyotes). An additional 13 wolves are not known to be associated with a pack.

A total of 76 sterile coyotes were monitored in the Red Wolf Recovery Area at the end of this quarter.

Wolf Pairings

One breeding pair of red wolves formed during the quarter. This likely was the result of the two wolves being captured and held together for a period of time before being released together in the female's territory. Her previous mate had been lost to gunshot during the 2012 fall hunting season.

Two mixed pairs (wolf-coyote) split up during the quarter, and three new mixed pairs formed. In all three cases, the new pair documentation was due to capturing, sterilizing, and releasing a previously unknown coyote that had paired with a wolf.

Wolf Captures and Radio-Telemetry Marking

Twenty-four red wolves were captured during the quarter, eight of which were first-time captures. All first-time captures were fitted with radio-telemetry collars (VHF or GPS) or surgically implanted with abdominal radio transmitters, and released. Captured red wolves consisted of 14 males and 10 females; 11 adults (>2 years), five juveniles (1-2 years), and eight pups (<1 year of age).

Thirty-one coyotes were captured and released during the quarter, 29 of which were first-time captures. All captured coyotes were sterilized before being radio-collared and released, and consisted of eight males and 23 females.

Dispersals

Three known male red wolves dispersed from their natal territories during the quarter: One adult (>2 years), one juvenile (1-2 years), and one pup (<1 year).

No known displacements occurred during the quarter.

Mortalities

Four wolves (1 male, 3 females) from the Red Wolf Recovery Area are known to have died during the quarter. Mortalities consisted of three adult wolves (>2 years) and one juvenile (1-2 years). Two of the deaths were the result of gunshot and are currently under investigation by the U.S. Fish and Wildlife Service's Office of Law Enforcement, one death appeared to be the result of vehicle collision, and one death was related to private trapping efforts.

Two radio-collared coyotes (both female juveniles) were known to have died during the quarter, one from gunshot and one from interspecific competition.

Disappearances

The Red Wolf Recovery Program lost radio contact with one adult female coyote during the quarter.

Pack Summaries

The Pack Summaries *section has been indefinitely discontinued due to recent events and current circumstances involving the apparent illegal take of red wolves within the Red Wolf Recovery Area.*

Species Survival Plan (SSP) Managed Population

Red Wolf Species Survival Plan (RWSSP) cooperating facilities are coordinated and managed by the SSP Coordinator and based at Point Defiance Zoo & Aquarium (PDZA) in Tacoma, Washington. The following information is based on activities completed or conducted by the SSP Coordinator during the quarter reported.

SSP Population Status

The SSP coordinates 42 captive facilities (e.g., approved zoos and nature centers) throughout the United States, housing 188 wolves, ranging from pups to geriatrics, at the end of the second quarter.

Breeding / Transfer Recommendations

The SSP Coordinator reported that a total of three wolves (all males) were transferred to two different SSP facilities.

Mortalities

One adult male wolf housed at the Western North Carolina Nature Center (WNC; Asheville, NC) and one adult female wolf at the Chattanooga Arboretum and Nature Center (Chattanooga, TN) were reported to have died during the second quarter.

SSP Facilities Updates

The 2012 International Red Wolf Studbook was completed and distributed to designated individuals and organizations as required by the World Association of Zoos and Aquariums (WAZA) International Studbook distribution list and posted on the Association of Zoos and Aquariums (AZA) Website.

The Trevor Zoo (Millbrook, NY) and the Red Wolf Recovery Program will share net proceeds with the International Crane Foundation through the Trevor Zoo's involvement with the Keep Safe Project fundraising event. Information about the Keep Safe Project and fundraising event can be found at – www.keepsafeproject.com.

The SSP Coordinator reported that PDZA staff conducted semen collection, evaluation, and cryo-banking (i.e., sample quality warranted banking) from a total of nine red wolves. Thanks to Karen Goodrowe-Beck, PhD, RWSSP Reproduction Advisor, and to the PDZA animal care and veterinary staff and staff at Wolf Haven International.

The SSP Coordinator also received notification from the Oklahoma City Zoo that they will be ending their participation in the RWSSP and therefore are seeking placement of their red wolf pair.

Other Activities

The SSP Coordinator provided a PhD student at George Mason University with information for her project entitled, "Development of Zoological Information Management System (ZIMS): Linking in situ and ex situ data management for conservation.

SSP staff performed an evaluation of post thaw motility and slide preparation of sperm samples, and collected morphological measurements for the Toronto Zoo. Inbreeding coefficients from individual's sampled were provided to cooperating investigators, Albrecht Schulte-Hostedde, Laurentian University, and Gabriela Mastromonaco, Toronto Zoo, for their research entitled "Sperm morphology and motility of the red wolf (*Canis rufus*)."

Island Propagation Sites

The U.S. Fish and Wildlife Service utilizes island sites to propagate red wolves and contribute to the restoration of a wild red wolf population, primarily by inserting island-born wolves into the wild population as a means to augment the wild red wolf gene pool with "under-represented" genes from the captive population. Currently, the Red Wolf Recovery Program cooperates with St. Vincent National Wildlife Refuge in maintaining a breeding pair of red wolves on an island site

Collaborations

Research

The Red Wolf Recovery Program provided financial and in-kind support for collaborative research with scientists at other institutions, including universities, interagency divisions, and non-government research organizations. These investigations required project staff to assist outside researchers and graduate students in their efforts to better understand red wolf ecology, ecosystem function, and conservation efforts.

Project Title: Prevalence of cystic endometrial hyperplasia and its effect on reproduction in the red wolf (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigator: Kadie Anderson, DVM, and Karen Wolf, DVM, Dipl. ACZM, Point Defiance Zoo & Aquarium (PDZA)

Project Title: Inbreeding avoidance in red wolves.
Graduate Student: Kristin Brzeski (PhD student)
Committee Chair/Principal Investigator: Sabrina Taylor, PhD, Louisiana State University

Project Title: Identifying management procedures to reduce red wolf-coyote interactions in eastern North Carolina.
Graduate Student: Joseph Hinton (PhD student)
Committee Chair/Principal Investigator: Michael Chamberlain, PhD, University of Georgia

Project Title: Use of stable isotope analysis to elucidate predation patterns of sympatric canids.
Graduate Student: Anne-Marie Hodge (MS student)
Committee Chair/Principal Investigator: Brian Arbogast, PhD, University of North Carolina at Wilmington

Project Title: Evaluating potential effects of widening US Highway 64 on red wolves, Washington, Tyrrell, and Dare Counties, North Carolina.
Graduate Student: Christine Proctor (PhD student)
Committee Chair/Principal Investigator: Michael R. Vaughan, PhD, Virginia Polytechnic Institute and State University (Virginia Tech)

Project Title: Sperm morphology and motility of the red wolf (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigators: Albrecht Schulte-Hostedde, PhD, Laurentian University, and Gabriela Mastromonaco, PhD, Toronto Zoo

Publications

The following publications have gone to print in this quarter. A complete list of publications related to red wolves can be found at http://www.fws.gov/redwolf/images/20121030_Bibliography.pdf.

Beeland, T.D. 2013. Are red wolves worth the trouble? Slate Magazine [Available Online Edition at http://www.slate.com/articles/health_and_science/animal_forecast/2013/02/red_wolf_recovery_program_will_climate_change_destroy_red_wolf_habitat.html].

Bohling, J.H., J.R. Adams, and L.P. Waits. 2013. Evaluating the ability of Bayesian clustering methods to detect hybridization and introgression using an empirical red wolf data set. Molecular Ecology 22: 74-86.

Dellinger, J.A., C. Proctor, TD. Steury, M.J. Kelly, and M.R. Vaughan. 2013. Habitat selection of a large carnivore, the red wolf, in a human-altered landscape. Biological Conservation 157: 324-330.

Presentations

No presentations by collaborators were reported during this quarter.

Staff and Volunteers

The Red Wolf Recovery Program employs eight full-time staff, including the program coordinator, assistant coordinator, field coordinator, three wildlife biologists, a biological technician, and an administrative assistant. The Red Wolf Recovery Program also benefits from unpaid interns (Caretakers).

Outreach

Staff from the Red Wolf Recovery Program conduct presentations and attend events to inform and educate the public on the conservation needs of the red wolf and the restoration efforts of the Red Wolf Recovery Program. As part of our effort to assist educators, red wolf "discovery boxes" that include materials about the red wolf are distributed to educational facilities. The distribution of discovery boxes is managed by the Red Wolf Coalition. Requests for discovery boxes should be made to kwheeler@redwolves.com.

The Red Wolf Recovery Program also seeks to achieve a quality visitor and participant experience in the U.S. Fish and Wildlife Service's priority recreational uses on National Wildlife Refuges. Our outreach efforts focus on four of the six program elements, including wildlife observation, wildlife photography,

environmental education, and interpretation, and are conducted frequently in partnership with ARNWR and Pocosin Lakes National Wildlife Refuge (PLNWR) educators and volunteers.

Presentations

Date	Location	Audience	Length	Attendance	Presenter
March 12	Manteo, NC	Kindergarten Wildlife Club	0.75 hrs (3x)	60	C. Heffley
March 13	Kill Devil Hills, NC	OBX Green Drinks	1 hr	~20	B. Bartel
March 14	Manteo, NC	Kindergarten Wildlife Club	0.75 hrs (3x)	60	C.Heffley/ D.Vice/S. Vice
March 15	Manteo, NC	Preschool Junior Naturalists	1 hr	15	C.Heffley/ D.Vice/S. Vice
March 20	Nags Head, NC	Kindergarten Wildlife Club	0.75 hrs (2x)	48	C.Heffley/ D.Vice/S. Vice
March 21	Nags Head, NC	Kindergarten Wildlife Club	0.75 hrs (2x)	48	C.Heffley/ D.Vice/S. Vice
March 28	Clemson University	Conservation Biology Class	0.5 hr	~70	D. Rabon
March 28	Clemson University	Graduate Student Luncheon	1 hr	18	D. Rabon
March 28	Clemson University	Agriculture and Natural Resources Seminar	1.5 hrs	45	D. Rabon

Website / Social Media

The Red Wolf Recovery Program has launched Facebook, Twitter, and Flickr pages. Our Facebook page connects our program with "friends" from around the world and informs them of the conservation efforts of the Red Wolf Recovery Program. Like us on Facebook at www.facebook.com/redwolfrecoveryprogram. The Twitter page also allows "followers" to connect with our program. Follow us on Twitter (www.twitter.com/redwolfrecovery) at @redwolfrecovery. Our Flickr page provides a site for users to view and download high resolution pictures related to red wolves and the Red Wolf Recovery Program. Our Flickr page can be found at www.flickr.com/photos/trackthepack.

The Red Wolf Recovery Program also has a weblog that highlights the efforts of the Red Wolf Recovery Program staff in the conservation of the red wolf. The weblog combines text, images, videos, and links to other media related to its topic. The content includes educational, informational, and general journal entries written by program staff, and allows readers to leave comments in an interactive format. The weblog can be found at trackthepack.blogspot.com.

Media Inquires

The Red Wolf Recovery Program responded to numerous media inquiries during this quarter, including the British Broadcasting Corporation (BBC), whose staff visited the recovery area for several days in March to film footage for their Pole to Pole Deadly 60 television show.

Partnerships

Red Wolf Coalition

The Red Wolf Coalition (RWC), a not-for-profit education organization based in Columbia, NC, advocates for the long term survival of wild red wolf populations by teaching about red wolves and by engaging the public in red wolf conservation. The RWC's web site (www.redwolves.com) provides information about the history, biology, and ecology of red wolves, as well as news about red wolf restoration. The RWC gives red wolf programs to school groups, professional organizations, university students, and other groups. The RWC also conducts workshops for teachers and non-formal educators, including people seeking certification in environmental education.

The RWC is working as an advisor on an ecotourism project with East Carolina University and Pitt Community College. This project involves design students from both schools and is using Palmetto Peartree Preserve, in Columbia, NC, as its base for the project. Students are working in groups to come up with a design and implementation plan for building construction, outdoor activities, and community involvement. This project is not funded, but is to give students the necessary tools needed to work in their chosen design fields. The final proposals will be presented to the public on April 22, 2013 from 10am to 3pm in the auditorium at the Pocosin Lakes National Wildlife Headquarters in Columbia, NC.

The Executive Director of RWC met with legislators in Raleigh to discuss the state rules allowing the hunting of coyotes at night and the impact it has on red wolf conservation in northeastern North Carolina.

The RWC hosted a group from the NC Museum of Science for their annual trip to northeastern North Carolina. A program about red wolf conservation was presented to 16 people at the Pungo Unit of Pocosin Lakes National Wildlife Refuge. The RWC Executive Director also reported conducting several education programs during the quarter, including presentations to the Cape Fear Sierra Club (Wilmington, NC), to members of the North Carolina Wildlife Society, to students of East Carolina University and Pitt Community College (Greenville, NC), to Edenton Alternative School (Edenton, NC), and to Superior Court Judge Russell Duke (Greenville, NC). The RWC participated in the science expo at the Hertford Grammar School. Lastly, the Executive Director of RWC gave a red wolf presentation at the Public Interest Environmental Law Conference in Eugene, OR.

The RWC has three Red Wolf Discovery Boxes for all grade levels available for educational use. These boxes are filled with a variety of hands-on items, activities and artifacts that help students explore the world of red wolves. The red wolf curriculum *Far Traveler* and a variety of books and other resources also are included. Contact Kim Wheeler at 252-796-5600 or kwheeler@redwolves.com for more information or to reserve your Red Wolf Discovery Box. The RWC distributed Red Wolf Discovery Boxes to four schools during the quarter.

Announcements

The U. S. Fish and Wildlife Service is requesting assistance with an investigation involving the suspected illegal take of a radio-collared red wolf that was recently found dead. The wolf was found with a suspected gunshot wound on January 18, 2013, north of the Town of Fairfield, in Tyrrell County, North Carolina. Anyone who has essential information that directly leads to an arrest, a criminal conviction, a civil penalty assessment, or forfeiture of property on the subject or subjects responsible for the suspected unlawful take of these red wolves may be eligible for a reward of up to $2,500. The red wolf is protected under the Endangered Species Act. The maximum criminal penalties for the unlawful taking of a red wolf are one year imprisonment and $100,000 fine per individual. Anyone with information on the death of this red wolf or any others, past or future, is urged to contact Special Agent Sandra Allred at (919) 856-4786, Refuge Officer Frank Simms at (252) 216-7504, or North Carolina Wildlife Resources Commission Officer Robert Wayne at (252) 216-8225.

Red Wolf

Recovery Program

Captive red wolf, Museum of Life and Science, Durham, NC.
Photo credit: Becky Bartel/USFWS

1st Quarter Report

October – December 2013

Coordinator: David R. Rabon Jr., PhD
Assistant Coordinator: Becky Bartel, PhD
Field Coordinator: Art Beyer
Wildlife Biologists: Chris Lucash, Ford Mauney, Michael L. Morse
Biological Technician: Ryan Nordsven
Administrative Assistant: Vacant
Intern(s) (Caretaker): Kate Hankins / DJ Sharp

www.fws.gov/redwolf

trackthepack.blogspot.com

www.facebook.com/redwolfrecoveryprogram

The Red Wolf Recovery Program

The red wolf (*Canis rufus*) is one of the most endangered canids in the world. Once occurring throughout the eastern and south-central United States, red wolves were decimated by predator-control programs and the loss and alteration of habitats. By the 1970s, these activities had reduced the red wolf population to a small area along the Gulf coast of Texas and Louisiana. To protect the species from extinction, the U.S. Fish and Wildlife Service initiated efforts to locate and capture as many red wolves as possible for the purposes of establishing a program to breed the species in captivity and one day reintroduce the species into a portion of its former range. More than 400 canids were captured in coastal areas of Texas and Louisiana, but only 17 were identified as pure red wolves. Fourteen of these wolves would become the founding members of the captive-breeding program and the ancestors of all red wolves existing today.

The first litter of red wolves born in captivity occurred in 1977. Within a few years red wolves were successfully reproducing in captivity, allowing the U.S. Fish and Wildlife Service to consider reintroducing the species in the wild. In 1987, four male-female pairs of red wolves were released in Alligator River National Wildlife Refuge (ARNWR) in northeastern North Carolina and designated as an experimental population. Since then, the experimental population has grown and the recovery area expanded to include four national wildlife refuges, a Department of Defense bombing range, state-owned lands, and private lands, encompassing about 1.7 million acres.

Adaptive Management

The recovery and restoration of red wolves requires the careful management of eastern coyotes (*C. latrans* var.) and occasionally wolf-coyote hybrids in the red wolf recovery area. The non-native coyotes spread across North Carolina to the red wolf recovery area in the early to mid-1990s. It soon was recognized that interbreeding between red wolves and eastern coyotes would produce hybrid offspring resulting in coyote gene introgression into the wild red wolf population, and that this introgression would threaten the restoration of red wolves. An adaptive management plan was developed to reduce interbreeding and introgression while simultaneously building the red wolf population. The adaptive management plan effectively uses techniques to capture and sterilize hormonally intact coyotes via vasectomy or tubal ligation, then releases the sterile canid at its place of capture to act as a territorial "placeholder" until the animal is replaced by wild red wolves. Sterile coyotes are not capable of breeding with other coyotes, effectively limiting the growth of the coyote population, nor are they capable of interbreeding with wild red wolves, limiting hybridization events. In addition, the sterile canid will exclude other coyotes from its territory. Ultimately, the placeholder canids are replaced by the larger red wolves either naturally by displacing the coyote or via management actions (e.g., removal of the coyote followed by insertion of wild or translocated wolves). Coyotes that are captured on private property are euthanized at the landowner's request.

Currently, adaptive management efforts are making progress in reducing the threat of coyotes to the red wolf population in northeastern North Carolina. Other threats, such as habitat fragmentation, disease, and anthropogenic mortality, also are of concern in the restoration of red wolves. Efforts to reduce these threats are presently being explored.

Program Objectives

The current recovery plan (U.S. Fish and Wildlife Service, 1990) specifies the following objectives:

1) Establish and maintain at least three red wolf populations via restoration projects within the historic range of the red wolf. Each population should be numerically large enough to have the potential for allowing natural evolutionary processes to work within the species. This must be paralleled by the cooperation and assistance of at least 30 captive-breeding facilities in the United States.
2) Preserve 80% to 90% of red wolf genetic diversity for 150 years.
3) Remove threats of extinction by achieving a wild population of approximately 220 wolves and a captive population of approximately 330 wolves.

4) Maintain the red wolf into perpetuity through embryo banking and cryogenic preservation of sperm.

Northeastern North Carolina Restored Population

We estimate between 90 and 110 red wolves in the Red Wolf Recovery Area, but for the purposes of this report all population figures are comprised only of known canids (i.e., those that are regularly monitored through either a functioning radio-collar or surgically implanted abdominal radio transmitter). Additional wolves are likely present, but have not been captured/radio-collared or their continued presence otherwise confirmed.

Beginning with the first quarter of the fiscal year 2012 (FY12) we have changed the way we report population and pack numbers. This change more accurately represents the managed population of canids that are part of our efforts to restore red wolves. The managed population includes wolf packs (i.e., packs consisting entirely of wolves) and mixed packs (i.e., packs of a wolf and sterile coyote pair). A pack is defined as at least two known canids cooperatively inhabiting an established territory.

Population and Territory Status

A total of 62 known red wolves occupied the Red Wolf Recovery Area (i.e., 1.7 million acres in five counties in northeastern North Carolina) at the end of the first quarter of our fiscal year 2014. The population includes 11 wolf packs (comprised of 36 wolves and 9 breeding pairs), and 8 mixed packs (comprised of 8 wolves and 8 sterile coyotes). An additional 18 wolves are not known to be associated with a pack.

A total of 61 sterile coyotes were monitored in the Red Wolf Recovery Area at the end of this quarter.

Pairings

Three breeding pairs of red wolves were lost during the quarter. One breeding pair was lost when the breeding male was killed by gunshot. Another breeding pair was lost when the breeding female was killed by gunshot. We lost radio contact with the breeding female from the third breeding pair. One breeding pair of red wolves formed during the quarter, resulting in a net loss of two breeding pairs.

Three mixed pairs (wolf-coyote) disbanded during the quarter. Two of the three mixed pairs ended with the death (by gunshot) of the wolf. One coyote also was killed by gunshot in one of the mixed pairs. The third mixed pair disbanded with the coyote being displaced by a new red wolf. One new mixed pair also was formed during the quarter.

Captures and Radio-Telemetry Marking

Seven red wolves were captured during the quarter, three of which were first-time captures. All first-time captures were fitted with radio-telemetry collars (VHF or GPS) or surgically implanted with abdominal radio transmitters, and six of the wolves were released. The remaining wolf is a breeding age male that was held in an acclimation pen within a female red wolf's territory in an attempt to create a new breeding pair. Captured red wolves consisted of two males and five females; four were adults (>2 years of age) and three were pups (<1 year of age).

Six coyotes (1 male, 5 females) were captured and released during the quarter, five of which were first-time captures. All captured coyotes were sterilized before being radio-collared and released.

Dispersals

Two known young male red wolves dispersed from their natal territories during the quarter.

One sterile, radio-collared male coyote was known to have been displaced by a male red wolf during the quarter.

Displacements

One young male red wolf was displaced from his natal territory with the arrival of a new breeding male.

Mortalities

Six adult red wolves (4 males, 2 females) from the Red Wolf Recovery Area are known to have died during the quarter. All of the mortalities were the result of gunshot with the exception of one that is suspected foul play, and all are currently under investigation by the U.S. Fish and Wildlife Service's Office of Law Enforcement.

Five sterile, radio-collared coyotes (3 males, 2 females) were known to have died during the quarter. Two were due to gunshot, two to vehicle collision, and one cause of death remains unknown. Two of these coyotes had previously left the recovery area and been lost to contact, so they were not represented in last quarter's population numbers.

The first quarter corresponds with the rifle hunting season in eastern North Carolina. Red wolf mortalities have historically been significantly higher during this quarter compared to the rest of the year.

Disappearances

The Red Wolf Recovery Program lost radio contact with one adult female wolf during the quarter.

Radio contact was also lost with four sterile, radio-collared coyotes during the quarter.

Pack Summaries

The Pack Summaries *section has been indefinitely discontinued due to recent events and current circumstances involving the apparent illegal take of red wolves within the Red Wolf Recovery Area.*

Species Survival Plan (SSP) Managed Population

Red Wolf Species Survival Plan (RWSSP) cooperating facilities are coordinated and managed by the RWSSP Coordinator, Will Waddell, and based at Point Defiance Zoo & Aquarium (PDZA) in Tacoma, Washington. The RWSSP is guided by a steering committee currently comprised of representation from the North Carolina Museum of Life and Science (Durham, NC), Chattanooga Arboretum and Nature Center (Chattanooga, TN), North Carolina Zoo (Asheboro, NC), Wolf Conservation Center (South Salem, NY), Miller Park Zoo (Bloomington, IL), and Western North Carolina Nature Center (Asheville, NC). The RWSSP also benefits from a volunteer advisory board in the fields of veterinary medicine (Dr. Karen Wolf, PDZA), reproduction (Dr. Karen Goodrowe Beck, PDZA), education (Craig Standridge, PDZA), population biology (Sarah Long, Lincoln Park Zoo), *in situ* population management (Dr. David Rabon, USFWS), and pathology (currently vacant). The following information is based on activities completed or conducted by the RWSSP Coordinator during the quarter reported.

RWSSP Population Status

The RWSSP coordinates 43 captive facilities (e.g., approved zoos and nature centers) throughout the United States, housing 193 wolves ranging from pups to geriatrics, at the end of this quarter.

Breeding / Transfer Recommendations

The RWSSP Coordinator reported that a total of 11 wolves were transferred to nine different SSP facilities and the island propagation site at St. Vincent National Wildlife Refuge during the quarter.

Mortalities

An adult female wolf housed at Northwest Trek (Eatonville, WA) was euthanized during the first quarter as a result of issues related to renal disease.

SSP Facilities Updates

No new cooperators joined the RWSSP program in the first quarter. Binghamton Zoo (Ross Park, NY) is making arrangements to receive wolves later this winter.

Wolf Haven International (Tenino, WA) coordinated a visit by Dr. Bruce Christensen from the University of California-Davis to conduct uterine biopsy sampling on two female red wolves housed at Wolf Haven International. This effort will assist in the early detection of potential reproductive diseases.

The Red Wolf Recovery Program received $300 from the Wolf Conservation Center (South Salem, NY) to equip the recently transferred breeding male wolf on St. Vincent Wildlife Refuge with its first radio-collar. We sincerely thank Wolf Conservation Center for this generous donation.

Other Activities

The RWSSP Coordinator completed and distributed the final breeding and transfer plan from the RWSSP planning meeting at Homosassa Springs State Wildlife Park (Homosassa, FL).

In October, Red Wolf Recovery Program staff, the RWSSP Coordinator, and researchers from multiple universities (Clemson University, Ohio State University, North Carolina State University, University of Idaho), federal (U.S. Geological Survey) and state agencies (NC Wildlife Resources Commission), and other non-governmental partners (Wildlands Network) met at the Museum of Life and Science (Durham, NC) to discuss ongoing issues and research priorities in red wolf conservation. We also received a tour of the RWSSP facility. We thank Animal Department Director, Sherry Samuels, and museum staff for coordination of the tour and their hospitality during our meeting. We also thank the Red Wolf Coalition for providing snacks and beverages for meeting attendants.

In November, the Red Wolf Recovery Program Assistant Coordinator traveled to PDZA (Tacoma, WA) to assist with veterinary exams of captive red wolves. A group comprised of staff from PDZA, Northwest Trek (Eatonville, WA), and Wolf Haven International (Tenino, WA) captured animals, administered health exams and vaccines, and collected blood samples. The Assistant Coordinator also met with zoo staff and presented a seminar on the red wolf recovery program.

During this quarter, project progress reports were submitted to PDZA's Conservation Committee for funding awarded in FY2013. Research currently is ongoing for three different projects: 1) investigating inflammatory bowel disease in red wolves (PDZA), 2) development of a canid disease monitoring and prevention program (USFWS, PDZA), and 3) population viability analysis and preliminary demographic models of red wolves (USFWS, PDZA, Lincoln Park Zoo [Chicago, IL]).

Island Propagation Sites

The U.S. Fish and Wildlife Service utilizes island sites to propagate red wolves and contribute to the restoration of a wild red wolf population, primarily by inserting island-born wolves into the wild population as a means to augment the wild red wolf gene pool with "under-represented" genes from the captive population. Currently, the Red Wolf Recovery Program cooperates with St. Vincent National Wildlife Refuge in maintaining a breeding pair of red wolves on an island site.

In December, the male red wolf from St. Vincent National Wildlife Refuge was captured and transferred to another RWSSP site in order to create a new breeding pair on the island. The wolf pair housed on the island was together for four years and did not produce any detected pups. LightHawk, a not-for-profit organization that provides aircraft flights as a tool to assist conservation projects throughout North America, generously donated a pilot and aircraft to transport the wolves. LightHawk pilots transported a male red wolf from Wolf Conservation Center (WCC; South Salem, NY) to St. Vincent National Wildlife Refuge, and then transported the male wolf from St. Vincent National Wildlife Refuge back to the WCC. We graciously thank LightHawk for their services. Many thanks also to Rebecca Bose at the WCC for her help with coordinating the transport, and to the staff at the Tallahassee Museum of Natural History (Tallahassee, FL) for being available for additional assistance.

Collaborations

Research

The Red Wolf Recovery Program provided financial and in-kind support for collaborative research with scientists at other institutions, including universities, interagency divisions, and non-government research organizations. These investigations required project staff to assist outside researchers and graduate students in their efforts to better understand red wolf ecology, ecosystem function, and conservation efforts.

Project Title: Prevalence of cystic endometrial hyperplasia and its effect on reproduction in the red wolf (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigator: Kadie Anderson, DVM, and Karen Wolf, DVM, Dipl. ACZM, Point Defiance Zoo & Aquarium (PDZA)

Project Title: Inbreeding avoidance in red wolves.
Graduate Student: Kristin Brzeski (PhD student)
Committee Chair/Principal Investigator: Sabrina Taylor, PhD, Louisiana State University
*Kristin recently received a Doctoral Dissertation Improvement Grant from the National Science Foundation to examine immunocompetence and disease resistance in the wild red wolf population.

Project Title: Identifying management procedures to reduce red wolf-coyote interactions in eastern North Carolina.
Graduate Student: Joseph Hinton (PhD student)
Committee Chair/Principal Investigator: Michael Chamberlain, PhD, University of Georgia

Project Title: Use of stable isotope analysis to elucidate predation patterns of sympatric canids.
Graduate Student: Anne-Marie Hodge (MS student)
Committee Chair/Principal Investigator: Brian Arbogast, PhD, University of North Carolina at Wilmington

Project Title: Evaluating potential effects of widening US Highway 64 on red wolves, Washington, Tyrrell, and Dare Counties, North Carolina.
Graduate Student: Christine Proctor (PhD student)
Committee Chair/Principal Investigator: Michael R. Vaughan, PhD, Virginia Polytechnic Institute and State University (Virginia Tech)

Project Title: Sperm morphology and motility of the red wolf (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigators: Albrecht Schulte-Hostedde, PhD, Laurentian University, and Gabriela Mastromonaco, PhD, Toronto Zoo

Publications

The following publications have gone to print in this quarter. A complete list of publications related to red wolves can be found at http://www.fws.gov/redwolf/images/RWBibliography.pdf.

Anderson, K., and K. N. Wolf. 2013. Medical management of pyometra in three red wolves (*Canis rufus*). Journal of Zoo and Wildlife Medicine 44:1010-1017.

Bartel, R. A., and D. R. Rabon, Jr. 2013. Re-introduction and recovery of the red wolf in the southeastern USA. Pgs 107-115 in P. S. Soorae (ed.), Global re-introduction perspectives: additional case studies from around the globe. IUCN/SSC Re-introduction Specialist Group, Abu Dhabi, UAE.

McVey, J. M., D. T. Cobb, R. A. Powell, M. K. Stoskopf, J. H. Bohling, L. P. Waits, and C. E. Moorman. 2013. Diets of sympatric red wolves and coyotes in northeastern North Carolina. Journal of Mammalogy 94:1141–1148.

Presentations

Dellinger, J. 2013. Habitat use of a large carnivore, the red wolf, in a human-altered landscape. 2013 International Wolf Symposium: Wolves and Humans at the Crossroads, October 10-13, Duluth, Minnesota.

Wheeler, K. 2013. The challenge of connecting local people to red wolf restoration. 2013 International Wolf Symposium: Wolves and Humans at the Crossroads, October 10-13, Duluth, Minnesota.

Staff and Volunteers

The Red Wolf Recovery Program employs eight full-time staff, including the Program Coordinator, Assistant Coordinator, Field Coordinator, three Wildlife Biologists, a Biological Technician, and an Administrative Assistant. The Red Wolf Recovery Program also benefits from unpaid interns (Caretakers).

Outreach

Staff from the Red Wolf Recovery Program conduct presentations and attend events to inform and educate the public on the conservation needs of the red wolf and the restoration efforts of the Red Wolf Recovery Program. As part of our effort to assist educators, red wolf "discovery boxes" that include materials about the red wolf are distributed to educational facilities. The distribution of discovery boxes is managed by the Red Wolf Coalition. Requests for discovery boxes should be made to kwheeler@redwolves.com.

The Red Wolf Recovery Program also seeks to achieve a quality visitor and participant experience in the U.S. Fish and Wildlife Service's priority recreational uses on National Wildlife Refuges. Our outreach efforts focus on four of the six program elements, including wildlife observation, wildlife photography, environmental education, and interpretation, and are conducted frequently in partnership with ARNWR and Pocosin Lakes National Wildlife Refuge (PLNWR) educators and volunteers.

Presentations

Date	Location	Audience	Length	Attendance	Presenter
October 23	ARNWR, NC	Howling Safari/ Wings Over Water	2 hrs	6	K. Hankins

October 25	ARNWR, NC	Howling Safari/ Wings Over Water	2 hrs	15	K. Hankins
November 6	Tacoma, WA	PDZA	1 hr	50	B. Bartel
November 15	Columbia, NC	NCSU	3 hrs	20	B. Bartel
November 16	ARNWR, NC	Howling Safari	2 hrs	45	K. Hankins
November 19	Waxhaw, NC	Rea View Elementary	4 hrs	600+	D. Rabon/ D. Beeland
December 2	Manteo, NC	Manteo Elementary First Flight Elementary	2 hrs	54	C. Heffley
December 7	ARNWR, NC	Howling Safari	2 hrs	10	K. Hankins

Website / Social Media

The Red Wolf Recovery Program has launched several social media sites. Our Facebook page connects the Red Wolf Recovery Program with "friends" from around the world and informs them of our conservation efforts. The Facebook page can be found at www.facebook.com/redwolfrecoveryprogram. Our Flickr page provides a site for users to view and download high resolution pictures related to red wolves and the Red Wolf Recovery Program. Our Flickr page can be found at www.flickr.com/photos/trackthepack.

The Red Wolf Recovery Program also has a weblog that highlights the efforts of the Red Wolf Recovery Program staff in the conservation of the red wolf. The weblog combines text, images, videos, and links to other media related to its topic. The content includes educational, informational, and general journal entries written by program staff, and allows readers to leave comments in an interactive format. The weblog can be found at trackthepack.blogspot.com.

Media Inquires

The Red Wolf Recovery Program responded to numerous media inquiries during this quarter, including the Washington Post (Washington, DC), Sun Journal (New Bern, NC), Virginia Pilot (Norfolk, VA), Charlotte Observer (Charlotte, NC), The Daily Reflector (Greenville, NC), NPR, All Things Considered, Public Radio East, Post and Courier (Charleston, SC), The Weather Channel, and freelance writers Moises Valesquez-Manoff and Cheryl Lyn Dybas.

Partnerships

Red Wolf Coalition

The Red Wolf Coalition (RWC), a not-for-profit education organization based in Columbia, NC, advocates for the long term survival of wild red wolf populations by teaching about red wolves and by engaging the public in red wolf conservation. The RWC's web site (www.redwolves.com) provides information about the history, biology, and ecology of red wolves, as well as news about red wolf restoration. The RWC gives red wolf programs to school groups, professional organizations, university students, and other groups. The RWC also conducts workshops for teachers and non-formal educators, including people seeking certification in environmental education.

The RWC Executive Director attended the International Wolf Symposium (Duluth, MN) in October and led two discussions on red wolf conservation. The RWC also was invited to speak at the NC National Wildlife Federation's board meeting, held in Pantego, NC. The RWC Executive Director reported it was a pleasure to speak with the group and took the opportunity to thank them directly for their contribution to the reward fund for the recent gunshot deaths of red wolves. The RWC Executive Director also participated in a radio interview on UNC Public Radio regarding red wolf conservation.

The RWC Executive Director reported conducting several education programs during the quarter, including presentations to a group from Wings Over Water that visited the Red Wolf Education & Healthcare Facility and had the opportunity to photograph the resident pair of red wolves. RWC also hosted six additional groups (147 people) from Raleigh, Nags Head, and Durham at the Red Wolf Education & Healthcare Facility. Reservations are required for those wishing to visit the center and can be scheduled online (http://redwolves.com/program/) or by phone (252-796-5600).

The RWC submitted a grant application to the Akron Zoo Conservation Fund for printing additional copies of the red wolf brochure. If awarded, these brochures will be distributed to RWSSP facilities.

The RWC also has three Red Wolf Discovery Boxes for all grade levels available for educational use. These boxes are filled with a variety of hands-on items, activities and artifacts that help students explore the world of red wolves. The red wolf curriculum *Far Traveler* and a variety of books and other resources also are included. Contact Kim Wheeler at 252-796-5600 or kwheeler@redwolves.com for more information or to reserve your Red Wolf Discovery Box. The RWC sent Discovery Boxes to six different schools in North Carolina, Virginia, and Washington this quarter.

Friends of the Red Wolf

The Friends of the Red Wolf (FORW) is a non-profit organization established to support the conservation and recovery of wild red wolves. The FORW is a program affiliate of The WILD Foundation (www.wild.org), which shares its 501(c)(3) non-profit status, and enables all donations to be tax-deductible as charitable contributions. Their work is informed by sound scientific research and adaptive management practices. They collaborate directly with the Red Wolf Recovery Program to help them achieve recovery goals for the red wolf. Their web site (friendsofredwolves.org) provides information about the ecology of red wolves, as well as news and updates about red wolf restoration.

The founder of FORW reported several activities during the quarter, including two presentations to an undergraduate class at Duke University and to students in K-5 grades of Rea View Elementary (Waxhaw, NC). Students at Rea View Elementary also were able to interact and explore hands-on items from a Discovery Box.

In December, the News & Observer (Raleigh, NC) published a rebuttal written by FORW founder in response to an earlier published opinion editorial piece on red wolves and coyotes. The article can be found at http://www.newsobserver.com/2013/12/05/3436039/t-delene-beeland-why-the-red-wolf.html.

Announcements

The U.S. Fish and Wildlife Service published several press releases requesting assistance with investigations on the recent suspected illegal take of a number of radio-collared red wolves. The press releases can be found at http://www.fws.gov/southeast/news/. Anyone with information that directly leads to an arrest, a criminal conviction, a civil penalty assessment, or forfeiture of property on the subject or subjects responsible for the suspected unlawful take of a red wolf may be eligible for a reward. Pledged contributions from the North Carolina Wildlife Federation, Red Wolf Coalition, Humane Society of the United States, and the Center for Biological Diversity have increased the reward amount up to $26,000. Anyone with information on the death of a red wolf is urged to contact Resident Agent in Charge John Elofson at (404) 763-7959, Refuge Officer Frank Simms at (252) 216-7504, or North Carolina Wildlife Resources Commission Officer Robert Wayne at (252) 216-8225.

Red Wolf

Recovery Program

Wild red wolf, northeastern North Carolina
Photo credit: Ryan Nordsven/USFWS

2nd Quarter Report

January – March 2014

Coordinator: David R. Rabon Jr., PhD
Assistant Coordinator: Becky Harrison, PhD
Field Coordinator: Art Beyer
Wildlife Biologists: Chris Lucash, Ford Mauney, Michael L. Morse
Biological Technician: Ryan Nordsven
Administrative Assistant: Vacant
Intern(s) (Caretaker): Cameron Feaster

www.fws.gov/redwolf

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The first litter of red wolves born in captivity occurred in 1977. Within a few years red wolves were successfully reproducing in captivity, allowing the U.S. Fish and Wildlife Service to consider reintroducing the species in the wild. In 1987, four male-female pairs of red wolves were released in Alligator River National Wildlife Refuge (ARNWR) in northeastern North Carolina and designated as an experimental population. Since then, the experimental population has grown and the recovery area expanded to include four national wildlife refuges, a Department of Defense bombing range, state-owned lands, and private lands, encompassing about 1.7 million acres.

Adaptive Management

The recovery and restoration of red wolves requires the careful management of eastern coyotes (*C. latrans* var.) and occasionally wolf-coyote hybrids in the red wolf recovery area. The non-native coyotes spread across North Carolina to the red wolf recovery area in the early to mid-1990s. It soon was recognized that interbreeding between red wolves and eastern coyotes would produce hybrid offspring resulting in coyote gene introgression into the wild red wolf population, and that this introgression would threaten the restoration of red wolves. An adaptive management plan was developed to reduce interbreeding and introgression while simultaneously building the red wolf population. The adaptive management plan effectively uses techniques to capture and sterilize hormonally intact coyotes via vasectomy or tubal ligation, then releases the sterile canid at its place of capture to act as a territorial "placeholder" until the animal is replaced by wild red wolves. Sterile coyotes are not capable of breeding with other coyotes, effectively limiting the growth of the coyote population, nor are they capable of interbreeding with wild red wolves, limiting hybridization events. In addition, the sterile canid will exclude other coyotes from its territory. Ultimately, the placeholder canids are replaced by the larger red wolves either naturally by displacing the coyote or via management actions (e.g., removal of the coyote followed by insertion of wild or translocated wolves). Coyotes that are captured on private property are euthanized at the landowner's request.

Currently, adaptive management efforts are making progress in reducing the threat of coyotes to the red wolf population in northeastern North Carolina. Other threats, such as habitat fragmentation, disease, climate change, and anthropogenic mortality, also are of concern in the restoration of red wolves. Efforts to reduce these threats are presently being explored.

Program Objectives

The current recovery plan (U.S. Fish and Wildlife Service, 1990) specifies the following objectives:

1) Establish and maintain at least three red wolf populations via restoration projects within the historic range of the red wolf. Each population should be numerically large enough to have the potential for allowing natural evolutionary processes to work within the species. This must be paralleled by the cooperation and assistance of at least 30 captive-breeding facilities in the United States.
2) Preserve 80% to 90% of red wolf genetic diversity for 150 years.
3) Remove threats of extinction by achieving a wild population of approximately 220 wolves and a captive population of approximately 330 wolves.

4) Maintain the red wolf into perpetuity through embryo banking and cryogenic preservation of sperm.

Northeastern North Carolina Restored Population

We estimate between 90 and 110 red wolves in the Red Wolf Recovery Area, but for the purposes of this report all population figures are comprised only of known canids (i.e., those that are regularly monitored through either a functioning radio-collar or surgically implanted abdominal radio transmitter). Additional wolves are likely present, but have not been captured/radio-collared or their continued presence otherwise confirmed.

Beginning with the first quarter of the fiscal year 2012 (FY12) we have changed the way we report population and pack numbers. This change more accurately represents the managed population of canids that are part of our efforts to restore red wolves. The managed population includes wolf packs (i.e., packs consisting entirely of wolves) and mixed packs (i.e., packs of a wolf and sterile coyote pair). A pack is defined as at least two known canids cooperatively inhabiting an established territory.

Population and Territory Status

A total of 69 known red wolves occupied the Red Wolf Recovery Area (i.e., 1.7 million acres in five counties in northeastern North Carolina) at the end of the second quarter of our fiscal year 2014 (FY 14). The population includes 9 wolf packs (comprised of 41 wolves and 7 breeding pairs), and 8 mixed packs (comprised of 8 wolves and 8 sterile coyotes). An additional 20 wolves are not known to be associated with a pack.

A total of 69 sterile coyotes were monitored in the Red Wolf Recovery Area at the end of this quarter.

Pairings

Two breeding pairs of red wolves were lost during the quarter. One of the losses occurred when the breeding female drowned in a private trapper's trap, and the second occurred when the breeding male died of natural cause.

There was no change in the number of mixed (wolf/sterile coyote) pairs during the quarter.

Captures and Radio-Telemetry Marking

18 red wolves were captured during the quarter, 12 of which were first-time captures. All first-time captures were fitted with radio-telemetry collars (VHF or GPS) or surgically implanted with abdominal radio transmitters, and released. Captured red wolves consisted of 7 males and 11 females; 4 adults (>2 years), 3 juveniles (1-2 years), and 11 pups (<1 year of age).

14 coyotes were captured and released during the quarter, all of which were first-time captures. All captured coyotes were sterilized before being radio-collared and released, and consisted of 7 males and 7 females.

Dispersals

No known wolves dispersed from their natal territories during the quarter.

Displacements

No known displacements occurred during the quarter.

Mortalities

Four adult wolves (3 males, 1 female) from the Red Wolf Recovery Area are known to have died during the quarter. One of the deaths was from natural cause, one drowned in a trap set by a private trapper, and two died from gunshot and are under investigation by the U.S. Fish and Wildlife Service's Office of Law Enforcement. The fifth wolf found dead this quarter is suspected of having been taken illegally during the previous quarter; the case currently is under investigation by the U.S. Fish and Wildlife Service's Office of Law Enforcement.

Four sterile, radio-collared male coyotes were known to have died during the quarter – one the result of gunshot, one from interspecific aggression (i.e., a wolf), and two euthanized after being caught by a private landowner.

Disappearances

The Red Wolf Recovery Program lost radio contact with 2 radio-collared, sterile coyotes during the quarter.

Pack Summaries

The Pack Summaries *section has been indefinitely discontinued due to recent events and current circumstances involving the apparent illegal take of red wolves within the Red Wolf Recovery Area.*

Species Survival Plan (SSP) Managed Population

Red Wolf Species Survival Plan (RWSSP) cooperating facilities are coordinated and managed by the RWSSP Coordinator, Will Waddell, and based at Point Defiance Zoo & Aquarium (PDZA) in Tacoma, Washington. The RWSSP is guided by a steering committee currently comprised of representation from the North Carolina Museum of Life and Science (Durham, NC), Chattanooga Arboretum and Nature Center (Chattanooga, TN), North Carolina Zoo (Asheboro, NC), Wolf Conservation Center (South Salem, NY), Miller Park Zoo (Bloomington, IL), and Western North Carolina Nature Center (Asheville, NC). The RWSSP also benefits from a volunteer advisory board in the fields of veterinary medicine (Dr. Karen Wolf, PDZA), reproduction (Dr. Karen Goodrowe Beck, PDZA), education (Craig Standridge, PDZA), population biology (Sarah Long, Lincoln Park Zoo), *in situ* population management (Dr. David Rabon, USFWS), and pathology (currently vacant). The following information is based on activities completed or conducted by the RWSSP Coordinator during the quarter reported.

RWSSP Population Status

The RWSSP coordinates 43 captive facilities (e.g., approved zoos and nature centers) throughout the United States, housing 191 wolves ranging from pups to geriatrics, at the end of this quarter.

Breeding / Transfer Recommendations

The RWSSP Coordinator reported that a total of total of nine wolves involving six different RWSSP facilities were transferred this quarter, including three females were transferred from Connecticut's Beardsley Zoo (Bridgeport, CT) to Binghamton Zoo at Ross Park, NY (a new RWSSP cooperator).

Mortalities

Two adult male wolves housed at the North Carolina Zoo (Asheboro, NC) and PDZA (Tacoma, WA) off-site facility were euthanized as a result of age/health related causes.

SSP Facilities Updates

One new cooperator – Binghamton Zoo (Ross Park, NY) – joined the RWSSP program in the second quarter. They received three female wolves from Connecticut's Beardsley Zoo.

Thank you to the North Carolina Zoo, North Carolina State University College of Veterinary Medicine (Raleigh, NC), Akron Zoo (Akron, OH), and PDZA for providing samples associated with the project to investigate the prevalence, clinicopathological and demographic characteristics of inflammatory bowel disease in red wolves.

The Red Wolf Recovery Program received $300 from the Wolf Conservation Center (South Salem, NY) to equip the recently transferred breeding male wolf on St. Vincent Wildlife Refuge with its first radio-collar. We sincerely thank Wolf Conservation Center for this generous donation.

Other Activities

The 2013 International Red Wolf Studbook was completed and distributed to designated individuals and organizations as required by the World Association of Zoos and Aquariums (WAZA) International Studbook distribution list and posted on the Association of Zoos and Aquariums (AZA) Website.

Dr. Karen Wolf, RWSSP Veterinary Advisor, and W. Waddell, RWSSP Coordinator, visited the NENC recovery area as part of the initial development of a canid disease monitoring and prevention program for red wolves.

Dr. Katie Seeley, Veterinary Intern at PDZA, is conducting a retrospective review of red wolf mortalities in the RWSSP over the last 15 years to gather information about the status of the red wolf population and identify major causes of mortality. Participating institutions were asked to submit gross necropsy and histology reports of the wolves that had been housed at their facilities. This information is currently being analyzed to identify trends within the RWSSP population and support long-term RWSSP management.

During this quarter, two red wolf proposals were awarded funding through PDZA's Dr. Holly Reed Conservation Fund.

1) Red Wolf (*Canis rufus*) Genome Resource Banking - integrating reproductive sciences into conservation programs (Award amount = $16,200).
   Project investigators: K. Goodrowe-Beck and W. Waddell.
   The purpose of this 3 year project is to expand semen collection, evaluation, processing, and cryopreservation of red wolf sperm beyond individual males maintained in the PDZA RWSSP population. To diversify samples collected for banking and thereby increase the gene diversity of the red wolf genome resource banking, sperm will be collected from individuals in the population at several other RWSSP institutions within identified U.S. geographic regions. Additionally, comparing the success of surgical and transcervical artificial insemination techniques using fresh (years 1 & 2) and frozen-thawed (years 2 & 3) semen will be evaluated.

2) Inflammatory bowel disease in the red wolf (*Canis rufus*): prevalence, clinicopathologic and demographic characteristics – continuation/extension from 2013 (Award amount = $3568.50). *Project investigators*: K. Wolf, K. Anderson, M. Garner, and W. Waddell.
   This project is an extension of work that was funded in 2013 and will further investigate gastrointestinal inflammatory response in affected red wolves fed a limited antigen commercial diet combined with the application of steroidal and ancillary therapeutics. Funding will also allow Dr. Karen Wolf the opportunity to share preliminary findings at the RWSSP meeting this summer and at the joint Association of Zoos & Aquariums Canid/Felid Taxon Advisory Group meeting at the National Zoo's Smithsonian Conservation Biology Institute (SCBI) in Front Royal, Virginia.

Island Propagation Sites

The U.S. Fish and Wildlife Service utilizes island sites to propagate red wolves and contribute to the restoration of a wild red wolf population, primarily by inserting island-born wolves into the wild population as a means to augment the wild red wolf gene pool with "under-represented" genes from the captive population. Currently, the Red Wolf Recovery Program cooperates with St. Vincent National Wildlife Refuge in maintaining a breeding pair of red wolves on an island site.

The new breeding pair of red wolves was held together in an acclimation pen most of the quarter. The female was examined by a local veterinarian to assess reproductive condition and fitted with a new radio-collar in early January. In late February, refuge staff conducted a pre-release visual health check and verified both radio-collars were properly working. Both animals appeared to be in good physical condition, and the pair was released in early March.

Collaborations

Research

The Red Wolf Recovery Program provided financial and in-kind support for collaborative research with scientists at other institutions, including universities, interagency divisions, and non-government research organizations. These investigations required project staff to assist outside researchers and graduate students in their efforts to better understand red wolf ecology, ecosystem function, and conservation efforts.

Project Title: Prevalence of cystic endometrial hyperplasia and its effect on reproduction in the red wolf (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigator: Kadie Anderson, DVM, and Karen Wolf, DVM, Dipl. ACZM, Point Defiance Zoo & Aquarium (PDZA)

Project Title: Inbreeding avoidance in red wolves.
Graduate Student: Kristin Brzeski (PhD student)
Committee Chair/Principal Investigator: Sabrina Taylor, PhD, Louisiana State University
*Kristin recently received a Doctoral Dissertation Improvement Grant from the National Science Foundation to examine immunocompetence and disease resistance in the wild red wolf population.

Project Title: Red Wolf (*Canis rufus*) Genome Resource Banking - integrating reproductive sciences into conservation programs.
Graduate Student: n/a
Committee Chair/Principal Investigator: Karen Goodrowe-Beck, PhD, and Will Waddell, Point Defiance Zoo & Aquarium (PDZA)

Project Title: Identifying management procedures to reduce red wolf-coyote interactions in eastern North Carolina.
Graduate Student: Joseph Hinton (PhD student)
Committee Chair/Principal Investigator: Michael Chamberlain, PhD, University of Georgia

Project Title: Use of stable isotope analysis to elucidate predation patterns of sympatric canids.
Graduate Student: Anne-Marie Hodge (MS student)
Committee Chair/Principal Investigator: Brian Arbogast, PhD, University of North Carolina at Wilmington

Project Title: Evaluating potential effects of widening US Highway 64 on red wolves, Washington, Tyrrell, and Dare Counties, North Carolina.
Graduate Student: Christine Proctor (PhD student)
Committee Chair/Principal Investigator: Michael R. Vaughan, PhD, Virginia Polytechnic Institute and State University (Virginia Tech)

Project Title: Inflammatory bowel disease in the red wolf (*Canis rufus*): prevalence, clinicopathologic and demographic characteristics.
Graduate Student: n/a
Committee Chair/Principal Investigators: Karen Wolf, DVM, Dipl. ACZM, Kadie Anderson, DVM, and Will Waddell, Point Defiance Zoo & Aquarium (PDZA); Michael Garner, DVM, Dipl. ACVP, Northwest ZooPath

Project Title: Canid disease monitoring and prevention program plan for the conservation of red wolves (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigators: Will Waddell, Karen Wolf, DVM, Dipl. ACZM, Point Defiance Zoo & Aquarium (PDZA); David Rabon, PhD, and Becky Harrison, PhD, USFWS

Project Title: Population viability analysis and demographic models of red wolves (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigators: Becky Harrison, PhD, David Rabon, PhD, USFWS; Lisa Faust, PhD, Sarah Long, MS, Lincoln Park Zoo; Will Waddell, Point Defiance Zoo & Aquarium (PDZA)

Project Title: Space use and survival of sterile "placeholder" coyotes (*Canis latrans*) in the conservation and management of red wolves (*Canis rufus*).
Graduate Student: n/a
Committee Chair/Principal Investigators: Eric Gese, PhD, Utah State University; Becky Harrison, PhD, David Rabon, PhD, USFWS

Publications

The following publications have gone to print in this quarter. A complete list of publications related to red wolves can be found at http://www.fws.gov/redwolf/images/RWBibliography.pdf.

Hinton, J.W. 2014. Red wolf (*Canis rufus*) and coyote (*Canis latrans*) ecology and interactions in northeastern North Carolina. PhD Dissertation. University of Georgia.

Presentations

No presentations by collaborators were reported during this quarter.

Staff and Volunteers

The Red Wolf Recovery Program employs eight full-time staff, including the Program Coordinator, Assistant Coordinator, Field Coordinator, three Wildlife Biologists, a Biological Technician, and an Administrative Assistant. The Red Wolf Recovery Program also benefits from unpaid interns (Caretakers).

Outreach

Staff from the Red Wolf Recovery Program conduct presentations and attend events to inform and educate the public on the conservation needs of the red wolf and the restoration efforts of the Red Wolf Recovery Program. As part of our effort to assist educators, red wolf "discovery boxes" that include materials about the red wolf are distributed to educational facilities. The distribution of discovery boxes is managed by the Red Wolf Coalition. Requests for discovery boxes should be made to kwheeler@redwolves.com.

The Red Wolf Recovery Program also seeks to achieve a quality visitor and participant experience in the U.S. Fish and Wildlife Service's priority recreational uses on National Wildlife Refuges. Our outreach

efforts focus on four of the six program elements, including wildlife observation, wildlife photography, environmental education, and interpretation, and are conducted frequently in partnership with ARNWR and Pocosin Lakes National Wildlife Refuge (PLNWR) educators and volunteers.

Presentations

Date	Location	Audience	Length	Attendance	Presenter
March 3	Manteo, NC	UNC-Wilmington	1 hr	15	B. Harrison
March 6-7	Manteo, NC	ENC/SEVA Team Meeting	1 hr	20	D. Rabon

Website / Social Media

The Red Wolf Recovery Program has launched several social media sites. Our Facebook page connects the Red Wolf Recovery Program with "friends" from around the world and informs them of our conservation efforts. The Facebook page can be found at www.facebook.com/redwolfrecoveryprogram. Our Flickr page provides a site for users to view and download high resolution pictures related to red wolves and the Red Wolf Recovery Program. Our Flickr page can be found at www.flickr.com/photos/trackthepack.

The Red Wolf Recovery Program also has a weblog that highlights the efforts of the Red Wolf Recovery Program staff in the conservation of the red wolf. The weblog combines text, images, videos, and links to other media related to its topic. The content includes educational, informational, and general journal entries written by program staff, and allows readers to leave comments in an interactive format. The weblog can be found at trackthepack.blogspot.com.

Media Inquires

The Red Wolf Recovery Program responded to numerous media inquiries during this quarter, including the Virginian Pilot (Norfolk, VA), North Carolina Wildlife Federation, National Wildlife Magazine, NPR, and several freelance writers.

Partnerships

Red Wolf Coalition

The Red Wolf Coalition (RWC), a not-for-profit education organization based in Columbia, NC, advocates for the long term survival of wild red wolf populations by teaching about red wolves and by engaging the public in red wolf conservation. The RWC's web site (www.redwolves.com) provides information about the history, biology, and ecology of red wolves, as well as news about red wolf restoration. The RWC gives red wolf programs to school groups, professional organizations, university students, and other groups. The RWC also conducts workshops for teachers and non-formal educators, including people seeking certification in environmental education.

The RWC Executive Director reported conducting several education programs during the quarter, including presentations to visitors at the Red Wolf Education & Healthcare Facility, including groups from North Carolina Wildlife Federation, NC Museum of Science, Carolina Nature Photography, and Southern Environmental Law Center. Reservations are required for those wishing to visit the center and can be scheduled online (http://redwolves.com/program/) or by phone (252-796-5600). Additionally, the RWC presented to 15 visitors on PLNWR.

The RWC received a grant in 2013 from the Akron Conservation Fund that was used to purchase transportation crates for the RWSSP program. We are very grateful to the Akron Conservation Fund for their support of red wolf conservation. Monies from this grant were also used to purchase tracking collars for the red wolves in the wild.

The RWC worked with the NC Wildlife Federation (NCWF) on their campaign to draw attention to the effects of climate change on the environment. The full report is available at: http://www.nwf.org/News-and-Magazines/Media-Center/Reports/Archive/2014/03-11-14-Mascot-Madness.aspx

The RWC also has three Red Wolf Discovery Boxes for all grade levels available for educational use. These boxes are filled with a variety of hands-on items, activities and artifacts that help students explore the world of red wolves. The red wolf curriculum *Far Traveler* and a variety of books and other resources also are included. Contact Kim Wheeler at (252) 796-5600 or kwheeler@redwolves.com for more information or to reserve your Red Wolf Discovery Box. The RWC sent Discovery Boxes to multiple schools this quarter including educators in New York and Washington. The Coalition gave education programs using the Discovery Boxes in local middle schools in Chowan and Washington Counties.

Friends of the Red Wolf

The Friends of the Red Wolf (FORW) is a non-profit organization established to support the conservation and recovery of wild red wolves. The FORW is a program affiliate of The WILD Foundation (www.wild.org), which shares its 501(c)(3) non-profit status, and enables all donations to be tax-deductible as charitable contributions. Their work is informed by sound scientific research and adaptive management practices. They collaborate directly with the Red Wolf Recovery Program to help them achieve recovery goals for the red wolf. Their web site (friendsofredwolves.org) provides information about the ecology of red wolves, as well as news and updates about red wolf restoration.

Announcements

The U.S. Fish and Wildlife Service published two press releases requesting assistance with investigations on the recent suspected illegal take of a number of radio-collared red wolves. The press releases can be found at http://www.fws.gov/southeast/news/. Anyone with information that directly leads to an arrest, a criminal conviction, a civil penalty assessment, or forfeiture of property on the subject or subjects responsible for the suspected unlawful take of a red wolf may be eligible for a reward. The Service is offering a reward of $2,500 for information that leads to the successful prosecution in this case. Anyone with information on the death of a red wolf is urged to contact Resident Agent in Charge John Elofson at (404) 763-7959, Refuge Officer Frank Simms at (252) 216-7504, or North Carolina Wildlife Resources Commission Officer Robert Wayne at (252) 216-8225.

2015

Using the "placeholder" concept to reduce genetic introgression of an endangered carnivore

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Using the "placeholder" concept to reduce genetic introgression of an endangered carnivore

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ABSTRACT

One of the most endangered species is the red wolf, *Canis rufus*. Reintroduction of the red wolf began in 1987, but in 1993 hybridization between coyotes (*Canis latrans*) and wolves was documented. To reduce genetic introgression, coyotes and coyote–wolf hybrids were captured, sterilized, and released as "placeholders". Placeholders held territories until either displaced or killed by a wolf, or management personnel removed them before releasing a wolf. We evaluated the placeholder concept by examining the number of animals sterilized and released, likelihood of displacement by a wolf, factors influencing displacements, territory fidelity of placeholders, and survival rates and causes of mortality of placeholders and wolves. Of the 182 placeholders, 125 were coyotes and 57 were hybrids. From 1999 to 2013, 51 placeholders were displaced or killed by wolves, and 16 were removed by management personnel. Thus, 37% of the placeholders were displaced leading to occupancy by a wolf. Most displacements occurred in winter (43%) and were always by the same sex. Males were more likely to be displaced than females. Home range characteristics influencing the probability of displacement included home-range size (i.e., more placeholders displaced from larger home ranges) and road density (i.e., more placeholders displaced from home ranges with lower road density). Annual survival of placeholders was higher than wolves in 12 of 14 years, with cause-specific mortality similar among wolves and placeholders. Placeholders provided territories for wolves to colonize, yet reduced the production of hybrid litters, thereby limiting genetic introgression to <4% coyote ancestry in the wolf population.

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1. Introduction

There is increasing concern about the status and distribution of many carnivore populations throughout the world (Schaller, 1996; Gittleman et al., 2001; Woodroffe, 2001; Ripple et al., 2014). With increasing human populations, many populations of carnivores are exposed to changes in land-use practices, increased habitat loss and fragmentation, increased human persecution, declines in natural prey species, increased disease transmission from domestic and wildlife species, illegal poaching, and increased competition with other carnivores (Gese, 2001; Sillero-Zubiri et al., 2004; Loveridge et al., 2010). As a result of these varied and diverse influences, many populations of large, medium, and small-bodied carnivores have undergone a general decline with some species now occupying a fragment of their former range (IUCN, 1990; Cole and Wilson, 1996; Woodroffe, 2001).

One threat facing a few carnivore species is hybridization resulting in genetic introgression with sympatric species (Wayne et al., 2004). While hybridization is an important evolutionary process (Allendorf et al., 2001), it poses a threat to the persistence and conservation of several wild canid species. Hybridization with domestic dogs poses a threat to the Ethiopian wolf (*Canis simensis*; Gottelli et al., 1994) and the European gray wolf (*Canis lupus*). Hybridization among several related canids in Ontario, Canada, could threaten the genetic integrity of a population of eastern wolves (*Canis lycaon*) in Algonquin Provincial Park (Patterson and Murray, 2008). In the United States, hybridization between red wolves (*Canis rufus*) and coyotes (*Canis latrans*) was identified as one of the greatest threats to conservation efforts and recovery of red wolves in eastern North Carolina (Kelly et al., 1999; Stoskopf et al., 2005). Reducing genetic introgression of coyote genes into the red wolf population presents a unique challenge for the U.S. Fish and Wildlife Service (USFWS), the agency charged with reintroducing and managing the current red wolf population (U.S. Fish and Wildlife Service, 1989, 2007).

In 1987, four pairs of red wolves were released at the Alligator River National Wildlife Refuge (ARNWR) in eastern North Carolina (Phillips and Parker, 1988). By 1993, the wolves had successfully bred and re-establishment of a free-ranging experimental population was considered to be a success (Phillips et al., 2003). The experimental population area primarily encompassed the Albemarle Peninsula, which did not have coyotes present during the initial reintroduction. However, by the early 1990s the presence of coyotes was documented and shortly thereafter hybridization between red wolves and coyotes occurred

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(Adams et al., 2003; Phillips et al., 2003). In 1999, a population and habitat viability assessment recognized several threats to the free-ranging red wolf population (Kelly et al., 1999), with hybridization with coyotes being the greatest threat to recovery of the species. Subsequently, the USFWS adopted a Red Wolf Adaptive Management Plan (RWAMP) with one of the objectives to reduce hybridization between coyotes and red wolves (Kelly, 2000).

As part of the RWAMP (Kelly, 2000), sterilization of coyotes and hybrid animals was proposed to reduce genetic introgression into the red wolf population. While sterilization has been tested as a management tool to reduce predation on domestic livestock and wild neonatal ungulates (Bromley and Gese, 2001a; Seidler et al., 2014) and proposed as a method for population control (Mech et al., 1996; Haight and Mech, 1997), using sterilization to reduce genetic introgression was a novel application. In essence, sterilized coyotes and hybrids would be allowed to remain on the landscape, maintaining social bonds and territories (Bromley and Gese, 2001b; Seidler and Gese, 2012), and serve as "placeholders" that would maintain territories, thereby reducing residency of home ranges in the recovery area by reproductive coyotes or hybrids, and thus reducing the threat of hybridization with a red wolf (i.e., producing hybrid offspring if pairing with a red wolf occurred; Stoskopf, 2012) and facilitating expansion of the red wolf population. The sterile placeholders could be displaced from their territories by a red wolf, or the USFWS could remove these sterile animals and release red wolves at that site when either a captive or wild-born red wolf was available for release. Sterilization was not used to control or manage the coyote population in the recovery area, but to create non-reproductive territories with sterile animals that were incapable of successfully reproducing with intact red wolves.

In late 1999, a plan to sterilize coyotes and hybrids to serve as placeholders in the Red Wolf Recovery Experimental Population Area (RWREPA) in eastern North Carolina was initiated. In this paper, we introduce and evaluate the placeholder concept as a management tool, covering its use in the red wolf recovery area from 1999 to 2013. As part of this evaluation, we examined (1) the number of animals (coyotes and hybrids) that were sterilized and released as placeholders, (2) the likelihood of a placeholder being displaced by a red wolf and the biotic and abiotic factors influencing these displacements, (3) the degree of territory fidelity of placeholders (i.e., the likelihood of dispersing after being sterilized), (4) survival rates and causes of mortality of both placeholders and red wolves, and (5) the number of hybrid litters born per year in the recovery area. Ultimately, the management goal is the reduction and eventual elimination of genetic introgression from coyotes into the red wolf population, thus allowing for continued persistence of a free-ranging population of red wolves in the wild.

2. Materials and methods

2.1. Study area

The Red Wolf Recovery Experimental Population Area (RWREPA) study area was located in northeastern North Carolina on the Albemarle Peninsula and encompassed approximately 4900 km^2 (Fig. 1). The peninsula is part of the South Atlantic Coastal Plain and is a combination of tidal (estuarine) and non-tidal (palustrine) wetlands, and mixed upland forests. The western region is dominated by mixed pine-hardwood forests of loblolly pine (*Pinus taeda*), white oak (*Quercus alba*), hickory (*Carya tomentosa*), beech (*Fagus grandifolia*), tulip tree (*Liriodendron tulipifera*), sweetgum (*Liquidambar styraciflua*), and red maple (*Acer rubrum*) (Hartshorn, 1972). Pocosins are palustrine wetlands endemic to the Atlantic coast and are found throughout the study area. The acidic and nutrient poor soils of pocosins facilitate dominance by pond pine (*P. serotina*) although loblolly and longleaf pine (*P. lalustris*) are common. The vegetation of the central region exhibits a gradual west-to-east change from upland species to palustrine wetlands dominated by tupelo (*Nyssa sylvatica*), Atlantic white cedar (*Chamaecyparis thyoides*), loblolly pine, and bald cypress (*Taxodium distichum*) (Lynch and Peacock, 1982; Moorhead and Brinson, 1995). Estuarine wetlands have their highest incidence in the eastern region of the study area (mainly Dare and Hyde counties), primarily along the coastline and are dominated by black rush (*Juncus roemerianus*) with areas of wetland grasses (*Spartina alterniflora*, *S. patens*, *Cladium jamaicense*), marsh elder (*Iva frutescens*), and false willow (*Baccharis angustifolia*) (Moorhead, 1992).

Within the RWREPA the principal landowners were private timber and agricultural corporations with federal and state governments having the next highest proportions of land ownership. There were numerous wildlife refuges contained within the study area with the two largest being the ARNWR and Pocosin Lakes National Wildlife Refuge

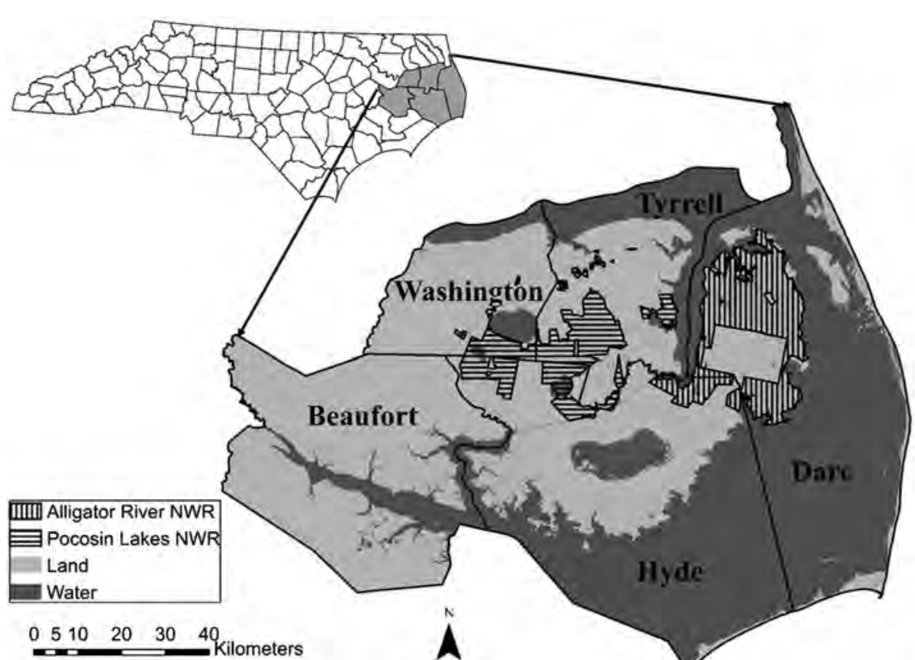

Fig. 1. The five county Red Wolf Recovery Experimental Population Area in northeastern North Carolina including the location of the two largest National Wildlife Refuges.

(PLNWR; Fig. 1). The ARNWR was located in the extreme northeastern section of the study area and was designated as the initial red wolf reintroduction site in 1987 due to a lack of coyotes and human presence, but with abundant prey (Phillips and Parker, 1988). Contained within the ARNWR was a 19,020-ha U.S. Air Force bombing range. The average annual rainfall for ARNWR was 145 cm without seasonal fluctuations, although 4.8 cm of snow falls annually during the winter (U.S. Department of the Interior, 2008). The 44,560-ha PLNWR was located in the central portion of the study area (Fig. 1). The total human population for the study area in 2010 was 105,124 people (U.S. Census Bureau, 2010).

2.2. Capture, sterilization, and monitoring of study animals

All capture, handling, aerial telemetry, and monitoring of red wolves, coyotes, and hybrids was conducted by USFWS personnel. Genetic analysis of blood samples collected from captured animals was used for species identification (Miller et al., 2003; Adams, 2006; Bohling et al., 2013). Beginning with the reintroduction in 1987, all red wolves released from captivity were equipped with a very high frequency (VHF) radio-collar (Telonics, Mesa, Arizona, USA; Phillips and Parker, 1988). Adults (>9 months old) born in the wild were trapped with a padded, foot-hold trap, immobilized, and fitted with a VHF radio-collar, body measurements and weight recorded, and a blood sample drawn. Pups born in the wild were implanted with an integrated transponder (PIT) tag (Trovan®; Beck et al., 2009). Radio-collared adult red wolves were located 2–3 times/week from an airplane or ground based vehicle. Starting in 2007, many red wolves were fitted with a GPS radio-collar (Lotek Wireless, Newmarket, Ontario, Canada) which obtained a location every 5 h (Dellinger et al., 2013).

Starting in 1999 and continuing through to 2013, adult (>9 months old) coyotes and hybrids within the RWREPA were sterilized to examine the feasibility of the placeholder concept. Captured coyotes and hybrids were either sterilized or removed (euthanatized) from the recovery area (Kelly, 2000; Gese et al., 2015), and thus there were no intact coyotes and hybrids monitored during this study. Upon capture in a padded, foot-hold trap, coyotes and hybrids were transported to a surgical facility, sterilized, then fitted with a VHF radio-collar (Telonics, Mesa, Arizona, USA), body measurements and weight recorded, and blood drawn. Females were sterilized by tubal ligation or spay, while males were vasectomized or neutered (Bromley and Gese, 2001b; Seidler and Gese, 2012). Animals spayed or neutered were classed as “hormones not intact”, while animals undergoing tubal ligation or vasectomy were classed as “hormones intact” (Asa, 2005). All surgical procedures were conducted by a licensed veterinarian after the animals were anesthetized. Animals were monitored overnight for post-operative complications and released at their capture site the following day. Research techniques and animal care procedures were conducted under permits and standard operating protocols approved by the U.S. Fish and Wildlife Service.

Sterilized coyotes and hybrids wearing VHF radio-collars were located on a regular basis (2–3 times/week) during the same aerial telemetry flights as the red wolves. Locations of the placeholders provided spatial information including home range location and boundaries (USFWS, unpublished data) for the 182 placeholders (Fig. 2). Data were also recorded for the date of displacement, the species which displaced or killed the coyote or hybrid, and if available, the specific individual that displaced the placeholder. Because aerial telemetry was conducted during the day, we were concerned if the home ranges determined from daytime locations may underestimate space use (Gese et al., 1990). However, the average home range size of the 182 VHF radio-collared resident placeholders in the study area was 23.5 ± 12.0 (range 5.5–64.5 km^2), similar to the mean home range of 27.2 km^2 for coyotes later equipped with GPS-collars (Hinton, 2014).

2.3. Biotic and abiotic factors influencing displacement

For each placeholder's home range, we determined the percent composition of 10 land cover types within their home range using ArcGIS 10.2.2 (ESRI, Redlands, California, USA). Land cover types were obtained from LANDFIRE 1.3.0 (LANDFIRE 1.3.0., 2012) and included agriculture, sparse, developed, herbaceous, marsh, riparian, shrubland, swamp, forest, and water. Land ownership was compiled from state GIS databases and included federal, state, private, and non-governmental organizations (NGO). A digital representation of primary and secondary roads was obtained from the North Carolina Department of Transportation (https://connect.ncdot.gov/resources/gis/; accessed July 2014). The length of primary and secondary roads in each home range was

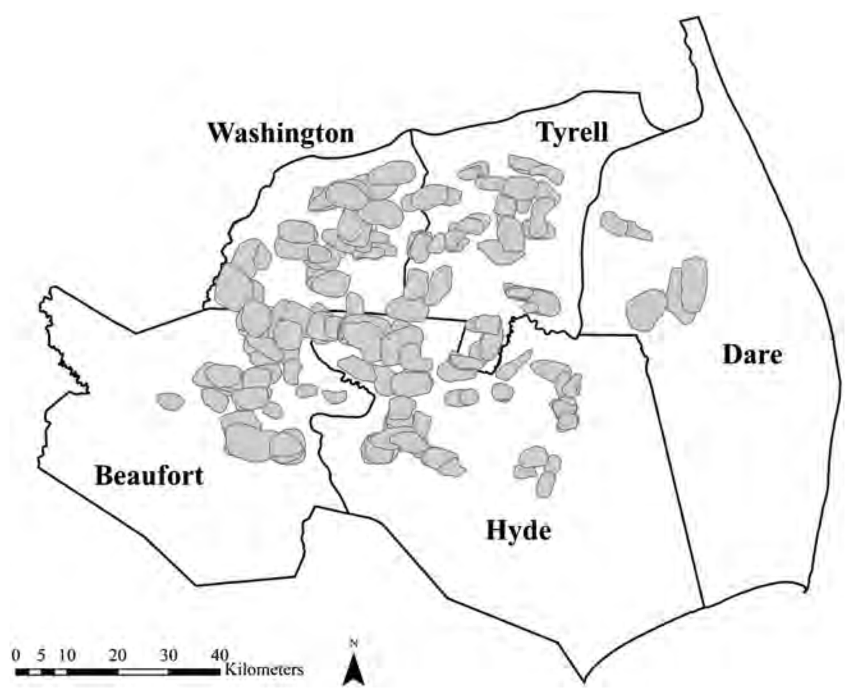

Fig. 2. Home ranges of placeholders (i.e., sterilized coyotes and hybrids) in the Red Wolf Recovery Experimental Population Area, North Carolina, 1999–2013.

converted to road density (km/km^2). We used generalized linear models (GLM) with a binomial distribution and logit link function to examine the influence of abiotic (home range characteristics) and biotic (placeholder characteristics) factors on the probability of being displaced ($y = 1$) or not displaced ($y = 0$) by a red wolf. Home range characteristics were assessed for each placeholder's home range, including home range size (km^2), road density (km/km^2), percent occurrence of each land cover type, dominant land cover type, percent occurrence of each land owner type, and dominant land owner type. Placeholder characteristics included sex of the placeholder, body length, and sterilization procedure (hormones intact or not intact). We developed separate GLMs to examine the effects of the home range and placeholder characteristics. Correlated variables ($r > 0.25$) were not allowed to enter the same model as additive or interactive effects.

We ranked all home range and placeholder characteristic GLMs and the null model using the Bayesian Information Criteria (BIC; Schwarz, 1978). Variables from the highest ranked model of home range characteristics were combined with variables from the highest ranked model of placeholder characteristics to generate a set of models containing both combinations of predictor variables, and we again used BIC (Schwarz, 1978) to compare models (Scheiner, 2004). All model development and analysis was conducted in the R statistical software (R Core Team, 2014).

2.4. Cause-specific mortality and survival rates

Radio-collared adult red wolves, coyotes, and hybrids were monitored 2–3 times/week allowing for the early detection of a mortality signal and facilitating recovery of the carcass to determine the cause of death. If applicable, a field necropsy was conducted, or if the cause of death was not apparent, the carcass was examined by a veterinary pathologist. We classified mortalities into one of three classes: anthropogenic, natural, or unknown. Anthropogenic mortality included any human-caused death not due to removal of coyotes or hybrids by agency personnel to make that home range available to a red wolf. Thus, anthropogenic mortality included causes of death from gunshot, vehicle collision, foul play, trapping, and poisoning. Foul play included suspected gunshot or suspected illegal take. Natural mortalities included health-related incidences such as disease or parasite load, and interspecific and intraspecific aggression resulting in death of the animal. A total of 182 placeholders and 410 red wolves were monitored from 1 January 1999 to 31 December 2013. We calculated annual survival rates for red wolves, sterile coyotes, and sterile hybrids using the program MICROMORT (Heisey and Fuller, 1985), but limited our survival analysis to the time period of 2000 to 2013 as there was only one sterile coyote and four sterile hybrids available for monitoring in 1999.

2.5. Composition of litters

During spring, personnel from the USFWS monitored radio-collared red wolves and located breeding females at active dens to determine the composition of the litter (Bohling and Waits, 2015; Gese et al., 2015). Pups born in the wild were implanted with an integrated transponder (PIT) tag (Trovan®; Beck et al., 2009) for future identification during subsequent capture operations in the fall when pups were large enough to be radio-collared. If the genetic origin of the litter was questionable, blood samples were obtained and examined using 18 nuclear DNA microsatellite loci to determine their ancestry and red wolf pedigree (Miller et al., 2003; Adams, 2006; Bohling et al., 2013).

3. Results

3.1. Displacement events

From 1999 to 2013, the USFWS captured, sterilized, and released 218 animals to serve as placeholders within the RWREPA. Of these, 15 were classed as transients (cf Gese et al., 1988), 13 were killed <3 months after release, and 8 disappeared (i.e., lost contact with the radio-collar) <3 months after release, thereby leaving 182 individuals for analysis. These 182 placeholders included 66 female and 59 male coyotes, and 26 female and 31 male hybrids. Of the 182 placeholders monitored, 51 were displaced by wolves (37 were spatially displaced by wolves from their territories and 14 were killed by a red wolf). In addition, 16 placeholders were removed by USFWS personnel and a red wolf released into the territory. Thus, 67 (37%) of the 182 placeholders were naturally displaced or artificially removed, leading to occupancy of the territory by a red wolf. During the same time period, 146 (35%) displacements out of 410 red wolves monitored were also documented. No coyote or hybrid displaced a red wolf; red wolves were displaced only by another red wolf. All displacements (100%) of placeholders were by a red wolf of the same sex. Similarly, for red wolves 98% of red wolf displacements were by a red wolf of the same sex.

Of the 51 naturally occurring displacements of placeholders, the frequency of displacements varied seasonally ($\chi^2 = 9.37$, df = 3, $P = 0.025$) with the most displacements occurring in winter (43%; 1 December–28 February), followed by spring (25%; 1 March–31 May), fall (18%; 1 September–30 November), and summer (14%; 1 June–31 August). Similarly, the 146 displacements of red wolves by red wolves varied seasonally ($\chi^2 = 31.64$, df = 3, $P < 0.001$) with most displacements occurring in winter (41%), followed by spring (26%), fall (25%), and summer (8%).

Although there were similar numbers of female (n = 92) and male (n = 90) placeholders, sterilized males were more likely to be displaced than sterilized females (males: 34.4% displaced, females: 21.7% displaced; $\chi^2 = 3.64$, df = 1, $P = 0.056$), regardless if the male was a sterile coyote (32.2%) or a sterile hybrid (38.7%; Fig. 3). Female placeholders that underwent tubal ligation and were hormonally intact were no more likely to be displaced than females that underwent a spay and were not hormonally intact (tubal ligation: 19.4% displaced; spay: 30.0% displaced; $\chi^2 = 1.025$, df = 1, $P = 0.31$; Fig. 4). Similarly, males that underwent vasectomy and were hormonally intact were also no more likely to be displaced than males that underwent a neuter surgery and were not hormonally intact (vasectomy: 32.9% displaced, neuter: 42.3% displaced; $\chi^2 = 0.519$, df = 1, $P = 0.47$; Fig. 4). The weight at capture of displaced female placeholders (13.21 ± 2.57 kg, standard deviation [SD]) was no different than female placeholders that were not displaced (13.50 ± 2.58 kg; t = 0.450, df = 30.499, $P = 0.65$). Similarly, the weight at capture of male placeholders that were displaced (15.84 ± 3.48 kg) was not different than the male placeholders that were not displaced (14.94 ± 2.58 kg; t = −1.265, df = 47.725, $P = 0.2119$).

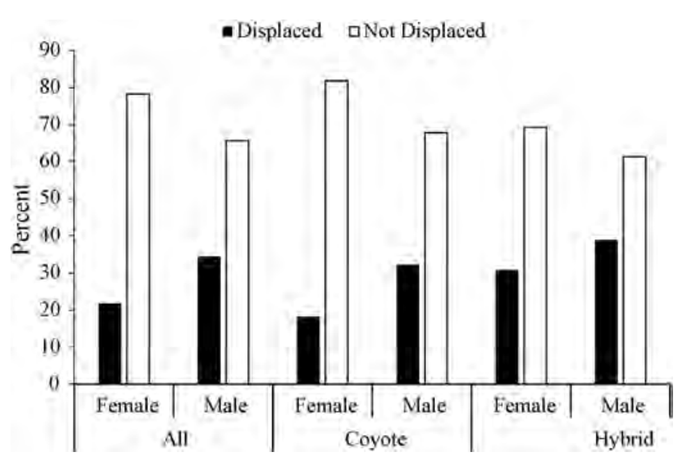

Fig. 3. The percent of male and female coyotes and hybrids serving as placeholders that were displaced and not displaced by red wolves in the Red Wolf Recovery Experimental Population Area, North Carolina, 1999–2013.

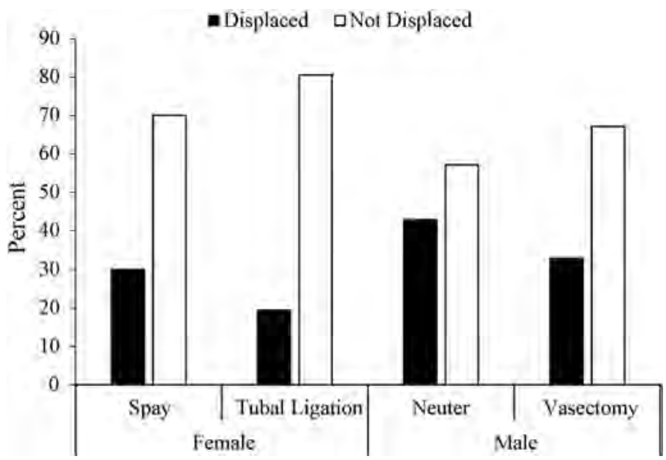

Fig. 4. The percent of 182 placeholders, sterilized by four methods, which were displaced and not displaced by red wolves in the Red Wolf Recovery Experimental Population Area, North Carolina, 1999–2013.

3.2. Biotic and abiotic factors influencing displacement

We examined the abiotic (home range characteristics) and biotic (placeholder characteristics) factors influencing the likelihood of a placeholder being displaced. Of the 63 models of home range characteristics examined plus the null model, the highest ranked was the null model followed by models containing home-range size or road density (Table 1). We found that the percent of placeholders displaced by a red wolf increased as home-range size increased (Fig. 5A). At home ranges <20 km^2, 17 of 85 (20%) placeholders were displaced by red wolves, while in contrast, 10 of 26 (38%) of the placeholders with home ranges >35 km^2 in size were displaced. In contrast, we found that the percent of placeholders displaced by a red wolf decreased with increasing road density, with displacements being highest at low road densities (Fig. 5B). All other models of home range characteristics had ΔBIC values >10 and model weights <0.01, thus home-range size and road density were carried forward to the combined models (Burnham and Anderson, 2002). Interestingly, neither the composition of land ownership or the dominant land ownership, nor the composition of land cover type or dominant land cover type influenced whether a placeholder was displaced by a red wolf.

Of the seven models of placeholder characteristics and the null model, the highest ranked was the null model followed by the univariate model of placeholder sex (Table 2). As described previously, we found male placeholders were more likely to be displaced than female placeholders (males: 34.4%, females: 21.7%). All other models of placeholder characteristics had ΔBIC values >4 and model weights <0.08, thus placeholder sex was the single variable carried over to generate the combined models. Of the eight combined models examined and the null model, the highest ranked model was the null model followed by the univariate model containing placeholder sex, then the univariate models containing home-range size and road density (Table 3).

Table 1
The ΔBIC and model weights for the generalized linear models and the null model examining the influence of home range characteristics within a placeholder's home range and the likelihood of being displaced by red wolves in the Red Wolf Recovery Experimental Population Area, North Carolina, 1999–2013.

Model	ΔBIC	df	Weight
Null	0.0	1	0.68
Home-range size (km^2)	2.6	2	0.19
Road density (km/km^2)	3.8	2	0.10
Home-range size (km^2) + Road density (km/km^2)	7.0	3	0.02

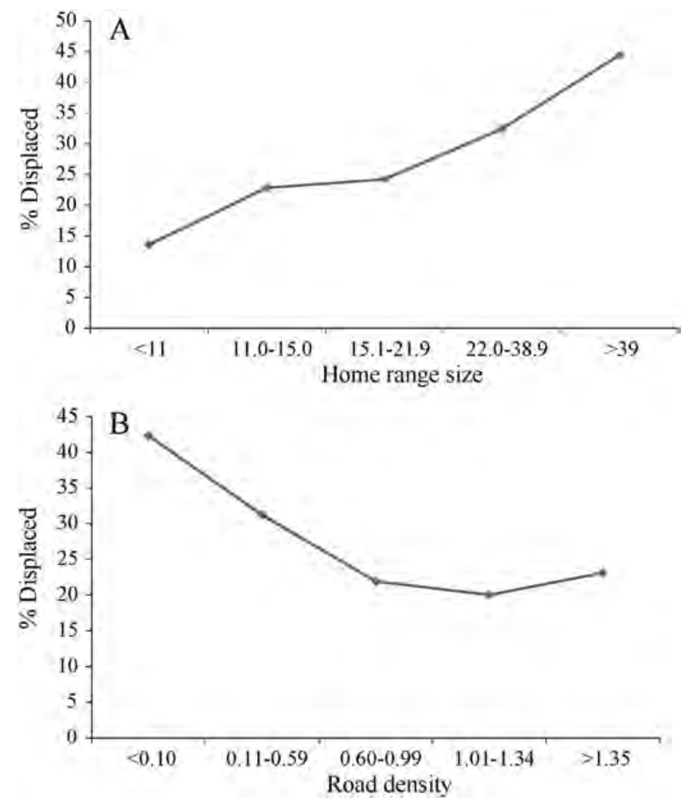

Fig. 5. The percent of placeholders displaced by a red wolf across (A) five classes of home-range size (km^2) of the placeholder, and (B) five classes of road density (km/km2) within a placeholder's home range, Red Wolf Recovery Experimental Population Area, North Carolina, 1999–2013.

3.3. Territory fidelity

Dispersal of juvenile animals from their natal home range is a common occurrence among most canid species. However, we emphasize that because only adult coyotes and hybrids >9 months of age were sterilized and used as placeholders, we only examined territory fidelity for adult canids in the study area (i.e., we did not include juvenile dispersal from their natal home ranges). Territory fidelity of adult canids was high during the study. During the 14 years of monitoring (2000–2013), of the 125 adult coyotes serving as placeholders, only 2 (1.6%) adult sterile coyotes dispersed from their resident territory. Of the 57 adult hybrid animals serving as placeholders, 4 (7.0%) adult hybrids dispersed from their territory. Similarly, of the 410 adult red wolves monitored during the same time period, 11 (2.7%) adult red wolves dispersed from their resident territory. In contrast to and for

Table 2
The ΔBIC and model weights for the generalized linear models and the null model examining the influence of placeholder characteristics on the likelihood of being displaced by red wolves in the Red Wolf Recovery Experimental Population Area, North Carolina, 1999–2013.

Model	ΔBIC	df	Weight
Null	0.0	1	0.56
Sex	1.5	2	0.26
Hormones intact	4.1	2	0.07
Body length (cm)	5.2	2	0.04
Sex + Hormones intact	5.3	3	0.04
Sex + Body length (cm)	6.6	3	0.02
Hormones intact + Body length (cm)	9.3	3	0.01
Sex + Hormones intact + Body length (cm)	10.4	4	0.00

Table 3
The ΔBIC and model weights for eight generalized linear models and the null model combining biologically meaningful characteristics of the placeholder and the placeholder's home range on the likelihood of being displaced by red wolves in the Red Wolf Recovery Experimental Population Area, North Carolina, 1999–2013.

Model	ΔBIC	df	Weight
Null	0.0	1	0.48
Sex	1.5	2	0.22
Home-range size (km^2)	2.6	2	0.13
Road density (km/km^2)	3.8	2	0.07
Home-range size (km^2) + Sex	5.0	3	0.04
Road density (km/km^2) + Sex	5.0	3	0.04
Home-range size (km^2) + Road density (km/km^2)	7.0	3	0.01
Home-range size (km^2) + Road density (km/km^2) + Sex	9.1	4	0.00
Home-range size (km^2) * Road density (km/km^2) + Sex	10.4	5	0.00

comparative purposes, we found that 103 (25.1%) of the juvenile red wolves dispersed at some time from their natal home range.

3.4. Survival rates and cause-specific mortality

We estimated annual survival rates for the 182 adult placeholders that were monitored for 137,784 radio-days (sterile coyotes: 84,093 radio-days; sterile hybrids: 53,691 radio-days) during 1999 to 2013. For comparison, we examined survival rates of 410 adult red wolves monitored for 388,587 radio-days during the same time period. In general, the sterilized adult placeholders (coyotes and hybrids combined) had higher survival rates than adult red wolves (Fig. 6). Mean annual survival was highest for sterilized hybrids (0.876 ± 0.11, standard deviation, SD), lowest for red wolves (0.80 ± 0.04) and intermediate for coyotes (0.843 ± 0.12). Red wolves exhibited higher annual survival than the placeholders in only two (14%) of the 14 years of the study, while placeholders had the highest survival in 12 (86%) of the 14 years monitored. Interestingly, sterilized coyotes had the highest survival in 6 (43%) of the 14 years and hybrids also had the highest survival in 6 (43%) of the 14 years.

Some sources of mortality among adult red wolves and adult placeholders were similar, while some specific causes were more species related (Table 4). Anthropogenic causes of mortality was similarly high for both adult red wolves and adult placeholders (red wolves vs. placeholders: $\chi^2 = 0.47$, 1 df, $P = 0.49$), and the number of deaths due to natural and unknown causes was similar (Table 4). A similar high percentage of red wolves and placeholders were killed by gunshot and foul play (red wolves vs. placeholders: $\chi^2 = 0.07$, 1 df, $P = 0.788$). Six red wolves were killed by poisoning and no placeholders were killed by poisoning (red wolves vs. placeholders: $\chi^2 = 1.65$, 1 df, $P = 0.199$). No red wolves were killed by placeholders (sterile coyotes or sterile hybrids), but 19% of the sterile coyote mortalities and 21% of the sterile hybrids mortalities were caused by interspecific aggression from red wolves (red wolves vs. placeholders: $\chi^2 = 50.36$, 1 df, $P = 0.0001$). Red wolves were rarely killed (~6% of mortality) by conspecifics (i.e., intraspecific aggression) and no placeholders were recorded as killed by conspecifics (red wolves vs. placeholders: $\chi^2 = 3.95$, 1 df, $P = 0.0469$).

Table 4
Anthropogenic, natural, and unknown causes of mortality for adult red wolves and sterile placeholders (coyotes, hybrids) in the Red Wolf Recovery Experimental Population Area, northeastern North Carolina, 1999–2013.

	Red Wolves % (n)	Sterile Coyotes % (n)	Sterile Hybrids % (n)
Anthropogenic			
Gunshot	37.1 (91)	23.8 (10)	33.3 (8)
Vehicle	17.6 (43)	19.0 (8)	8.3 (2)
Foul Play	4.1 (10)	14.3 (6)	8.3 (2)
Trapping	2.4 (6)	4.8 (2)	4.2 (1)
Poisoning	2.4 (6)	0 (0)	0 (0)
Total	63.7 (156)	61.9 (26)	54.2 (13)
Natural			
Health-related	11.8 (29)	0 (0)	4.3 (1)
Interspecific	0 (0)	19.0 (8)	20.8 (5)
Intraspecific	5.7 (14)	0 (0)	0 (0)
Total	17.6 (43)	19.0 (8)	25.0 (6)
Unknown	18.8 (46)	19.0 (8)	20.8 (5)
Total deaths	245	42	24

3.5. Composition of litters

In general there was little variation in the number of hybrid litters from 2000 to 2013 with a mean of 2 hybrid litters/year (± 1, standard deviation) with a maximum of 5 litters in 2006 and no hybrid litters in 2004 (Fig. 7). During the same time period, the number of red wolf litters has varied with a mean of 9 litters (± 2) and ranged from 6 to 12 litters each year.

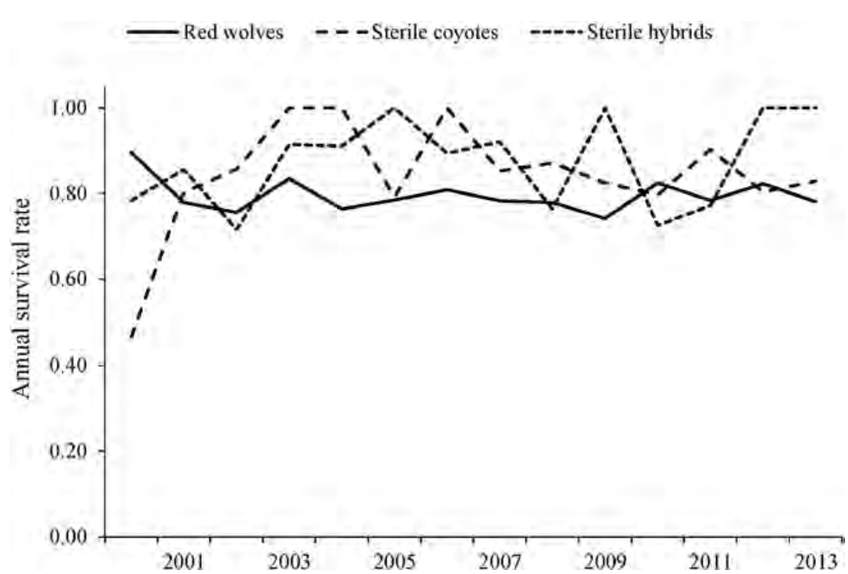

Fig. 6. Annual survival rates of adult red wolves (n = 410), sterilized adult coyotes (n = 125), and sterilized adult hybrids (n = 57), in the Red Wolf Recovery Experimental Population Area, North Carolina, 2000–2013.

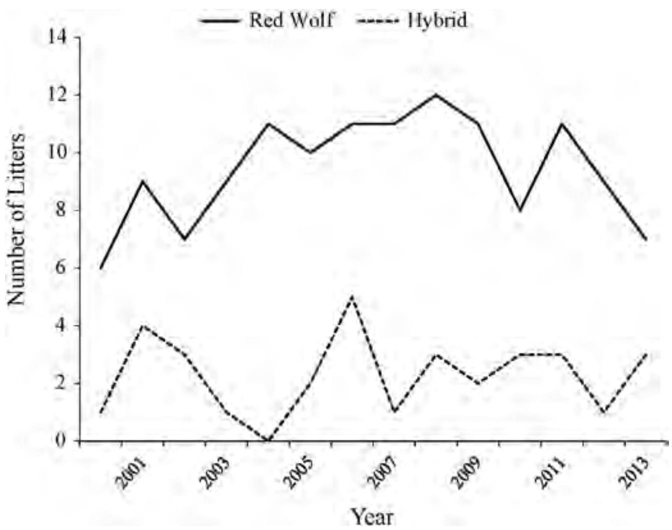

Fig. 7. The number of red wolf and hybrid litters in the Red Wolf Recovery Experimental Population Area, North Carolina, 2000–2013.

4. Discussion

Many factors threaten the persistence of canid populations throughout the world (Gittleman et al., 2001; Woodroffe, 2001; Ripple et al., 2014). Hybridization with coyotes followed by genetic introgression was identified as one of the greatest threats to recovery of red wolves in North Carolina (Kelly et al., 1999). Sterilization of coyotes and hybrid individuals was proposed to serve as placeholders to reduce hybridization and genetic introgression of the red wolf population (Kelly, 2000). This is the first documented case of using sterilization and the placeholder concept to mediate hybridization and genetic introgression between similar taxonomic canids. The primary objective of the placeholder concept was to limit opportunities for intact red wolves to produce viable offspring during mating events with coyotes or hybrid animals, as well as keeping space available for red wolves without the threat of producing hybrid offspring if pairing with a red wolf occurred (Stoskopf, 2012). These sterile placeholders could then be displaced from these territories by a red wolf, or these sterile animals could be removed and red wolves released into the now empty territory. Sterilization was not used to control or manage the coyote population in the recovery area, but to create non-reproductive territories with sterile animals that were incapable of successful reproduction (i.e., hybridization).

Natural displacements and strategic management removals of placeholders resulted in 37% of those sterile placeholders being replaced by red wolves in that territory. Displacements were unidirectional with red wolves displacing and replacing placeholders, but no placeholder displaced red wolves during the 14 years of monitoring. Interestingly, animals not having hormonal systems intact (i.e., animals spayed or neutered) were not displaced at a higher frequency than sterile animals with intact hormones (i.e., animals tubal ligated or vasectomized). Intact hormonal systems are generally believed to be necessary for pair bonding and territorial maintenance (Asa, 1995). The higher frequency of displacements in winter is not surprising given that the breeding season would compel animals to seek mating opportunities. The finding that male red wolves displaced male placeholders, and female red wolves displaced female placeholders reinforces the mating opportunity hypothesis.

We found that home range size and road density influenced the percentage of placeholders displaced by red wolves. At home ranges <20 km^2, 20% of the placeholders were displaced by red wolves, while 38% of the placeholders with home ranges >35 km^2 were displaced. Red wolves have larger home ranges (Chadwick et al., 2010) than coyotes, and may thus prefer to acquire larger areas in which to establish residency. Similarly, home ranges of placeholders that contained low road densities were preferred by red wolves, leading to higher displacement rates. Dellinger et al. (2013) reported red wolves avoided areas with high human density, and suggested red wolves will use human-associated landscapes, but modify their habitat selection patterns with increased human presence. Thus large home ranges with low road density appear to be preferred by red wolves and placeholders occupying said home ranges have a higher likelihood of being displaced. Interestingly, of the 26 placeholders with home ranges >35 km^2, the 10 placeholders displaced had a median home range size of 47 km^2 and a median road density of 0.48 km/km^2, while the 16 placeholders not displaced had a median home range size of 41 km^2 and a median road density of 0.63 km/km^2. Past studies on gray wolves have suggested wolves tended to survive where human density was low and road density was <0.58 km/km^2 (Thiel, 1985; Mech et al., 1988). Red wolves and coyotes used similar habitats and space (Hinton, 2014), thus the lack of habitat variables influencing displacements was likely due to similar habitat selection and requirements.

Annual survival rates of placeholders were higher than red wolves in 12 of the 14 years of monitoring. Coyotes and hybrids each had the highest survival rates in 6 of the 14 years. Even first generation hybrids had survival values more similar to coyotes than red wolves, indicating that hybridization conferred some level of increased survival abilities more reminiscent of coyotes. Perhaps the smaller body size, dietary breadth (Hinton, 2014), and behavioral plasticity of hybrids, which are more similar to coyotes than red wolves, also allowed for increased survival rates. Coyotes are adaptable to human-modified environments (Bekoff and Gese, 2003; Gehrt, 2004; Gese et al., 2012), and hybridization appeared to confer similar "coyote-like" survival traits to hybrid individuals.

While causes of mortality were similar among red wolves, coyotes, and hybrid animals, red wolves did experience a higher frequency of gunshot and health-related mortality. The high red wolf mortality due to gunshot is cause for concern as many of these mortalities occurred in the breeding season during the past 2–3 years (Hinton et al., in review) and not only limited potential litter production of red wolf pairs in the last 2 years (Fig. 7), but also opened opportunities for hybridization between red wolves and coyotes by reducing mating opportunities with red wolves (Bohling and Waits, 2015; Gese et al., 2015). While sterilization of placeholders does limit successful reproduction between red wolves and coyotes, it is impractical to capture and sterilize all coyotes in the recovery area.

While only 37% of the placeholders were naturally or artificially displaced leading to red wolf occupancy of the territory, the remaining 63% did protect space in which no hybrid litters could be produced. Ultimately, limiting genetic introgression into the red wolf population is the overall goal of the use of the placeholder concept. In 2014, the genetic composition of the wild red wolf population was estimated to include <4% coyote ancestry from recent introgression since reintroduction (Gese et al., 2015). Use of placeholders, combined with removal of coyotes and hybrids, release of captive adult red wolves, and cross-fostering of captive pups into wild red wolf litters, appeared to be effectively limiting genetic introgression into the red wolf population (Gese et al., 2015). Continued intensive management will likely be necessary in the future to limit hybridization and genetic introgression. Using the placeholder concept to limit hybridization in other canid species has potential. Hybridization with domestic dogs poses a threat to the Ethiopian wolf (Gottelli et al., 1994) and the European gray wolf, but sterilization to generate placeholders may not be an effective strategy in these situations because domestic dogs are the introgressing species and sterilizing all free-ranging domestic dogs would be impossible. Using the placeholder concept to reduce or limit hybridization among several related canids in Ontario and reduce the threat of genetic introgression into a population of eastern wolves in Algonquin Provincial Park (Patterson and Murray, 2008) may be more practical.

5. Conclusions

Sterilization has been used in the recent past to reduce predation rates by coyotes on domestic and native ungulates (Bromley and Gese, 2001a; Seidler et al., 2014), but using sterilization to limit genetic introgression into the red wolf population is the first use of sterile animals within the context of the "placeholder" concept. We emphasize that sterilization was not used to limit the distribution or size of the coyote population, but to reduce the incidence of hybridization between coyotes and red wolves and genetic introgression into the red wolf population. Results from this experiment demonstrate the utility of the placeholder concept to limit genetic introgression of coyotes into the recovering red wolf population in northeastern North Carolina. Territories were held by sterilized placeholders and then being successfully displaced by red wolves resulting in red wolf occupancy. Equally important was production of hybrid litters was limited to a few each year in the recovery area, and the genetic composition of the red wolf population in 2014 contained <4% coyote introgression. The utility and application of the placeholder concept may be practical for limiting genetic introgression in similar situations where an introgressing species threatens the genetic integrity of a sympatric carnivore.

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Population Year (Oct 1-Sept 30)	Total Absolute Pop Estimate
1987-88	16.000
1988-89	15.000
1989-90	31.000
1990-91	34.000
1991-92	43.603
1992-93	66.836
1993-94	51.926
1994-95	44.372
1995-96	51.891
1996-97	45.923
1997-98	69.141
1998-99	90.145
1999-00	104.268
2000-01	95.798
2001-02	96.789
2002-03	102.139
2003-04	112.936
2004-05	124.634
2005-06	126.525
2006-07	115.856
2007-08	114.790
2008-09	111.400
2009-10	111.177
2010-11	111.956
2011-12	104.189
2012-13	112.219

Standard Error Total Absolute Pop Estimate	Year
0	1999-00
0	2000-01
0	2001-02
0	2002-03
0.050950932	2003-04
0.04691757	2004-05
0.062210291	2005-06
0.212675591	2006-07
0.231553704	2007-08
0.189782315	2008-09
0.187387847	2009-10
0.249394299	2010-11
0.560295504	2011-12
0.571296093	2012-13
0.892236646	2013-14
1.193348524	
1.247573301	
1.486532566	*Estimates
1.721565355	these totals
1.484075335	
1.689187308	
1.482139309	
1.483726077	
1.288979558	
1.419335797	
1.634307088	

#of Breeding pairs*
7
14
11
20
20
15
15
20
18
15
15
16
17
13
8

from observation in February of a given (e.g., 1999-2000 is Feb. 2000),
s reflect loss of breeders observed previous fall and management efforts to replace lost breeders (inser

ertions

Mortalities by COD as of 9/1/2014

Population Year	Health-related	Intraspecific competition	Management	Vehicle	Poison
1987-88	2			2	
1988-89	1	1		1	
1989-90				2	
1990-91	3	5		3	
1991-92				1	
1992-93	3				
1993-94	10		1	6	
1994-95	2		1	1	3
1995-96	1	1		1	1
1996-97	1	2	2	3	
1997-98		1		4	
1998-99	5		1	1	
1999-00			5	2	
2000-01	1			3	
2001-02	3	3		4	5
2002-03	4	3	2	3	
2003-04	3	2		6	
2004-05	3	1	2	2	
2005-06	5			4	
2006-07		1	1	4	
2007-08	2	1		3	2
2008-09		1		5	
2009-10	3	1		4	
2010-11	4	1		3	
2011-12			3	1	
2012-13	1			5	
2013-14#	1			2	
Totals	58	24	18	76	11

Population Year = Oct 1-Sept 30 (2014 incomplete)

* Vehicle collisions include tractors and farm equipment.

Gunshot	Other suspected illegal take	Private Trapper	Unknown	Total
0				4
0				3
0		1		3
1				12
0			1	2
0				3
1			4	22
3		1	3	14
2			3	9
0		1	2	11
1			5	11
3			2	12
4	2		5	18
3		1	8	16
4	1			20
4		1		17
3	1		1	16
4	2	2	2	18
6		1	3	19
9		1	4	20
5	2	1	5	21
5	1	3	10	25
6	2		4	20
5		1	6	20
8	2		1	15
11		1	3	21
7	2	1	1	14
95	15	16	73	386

Birth Year	# pups
1988	2
1989	0
1990	0
1991	13
1992	2
1993	16
1994	34
1995	22
1996	19
1997	19
1998	13
1999	44
2000	40
2001	51
2002	39
2003	42
2004	55
2005	39
2006	51
2007	31
2008	51
2009	41
2010	44
2011	46
2012	40
2013	34
2014	19

*1988-1999 observations were based on field sightings or recaptures
2000-present observations were based on den counts--these numbers may be higher than totals reported i

These totals only reflect pups detected and do not include fosters or releases
These totals may be amended if we discover animals during trapping season as first time captures (where w

l in quarterly reports as in some cases animals died before processing and were never assigned studbool

we may have not had access to a suspected den site previously

k number

coyotes and hybrids. You have also imposed a one year jail term and $100,000 fine for killing a red wolf. What is your punishment for your previously noted violations of this ACT? You have told hunters not to shoot coyotes east of Hwy 32 (see attachment). By your own admission all three species (coyotes, hybrids, red wolves) look alike. In fact DNA scientists have difficulty distinguishing the differences (see "wolf is 76% coyote" and genetic mess is "canis soup" attachments). So here we sit, if your program is successful, you have expanded wolves throughout NC and they have interbred and created a super coyote now capable of way more damage than a regular coyote, that no one can distinguish or kill because they can be put in jail for a year and fined $100,000. This is sheer stupidity. NC residents and sportsmen need to have a thorough understanding of these facts before our wildlife landscape is permanently damaged. We are afraid it is too late for our farm, but maybe this letter can protect others from what we have suffered.
Sincerely,

[redacted]

IGNORED LETTER
On March 22, you were hand delivered a request to remove your red wolves from our property in Tyrrell County. On March 26, you were sent a follow up email reiterating our request for the immediate removal of your wolves by April 5th. To date, you have made no attempt to provide to us, as private landowners, our protection allowed by law. This law furthermore allows private land owners the ability to remove your wolves from our property when your attempts fail or are abandoned. This is not the end result that we wanted, but you have left us with no other choice. You had the ability to recapture these wolve and use them in a captive breeding program as stipulated in the 1995 rules revision, yet you have chosen not to act to protect either the wolves or us. We are now asking permission, as provided by the law, for us to have these wolves removed ourselves. Your failure to act on this request will be taken as an affirmative reponse to this request.
Sincerely,

[redacted]

-----Original Message-----
From: Rabon, David <david_rabon@fws.gov>
To: [redacted] <[redacted]aol.com>
Cc: jrprewitt007 <jrprewitt007@gmail.com>; Myers, Gordon S. <gordon.myers@ncwildlife.org>; mallory.martin <mallory.martin@ncwildlife.org>
Sent: Mon, Apr 15, 2013 4:14 pm
Subject: Re: Removal of Red Wolves

Dear Mr. [redacted]

I apologize for the delay in responding. I have been out of the office quite a bit since our meeting in Raleigh, but I want to assure you that I

Leopoldo Miranda <leopoldo_miranda@fws.gov>

From:	Leopoldo Miranda <leopoldo_miranda@fws.gov>
Sent:	Wed Apr 24 2013 07:13:35 GMT-0600 (MDT)
To:	david_rabon@fws.gov
Subject:	Re: Fw: Removal of Red Wolves

Thanks! This clarifies a lot!

Leo

From: Rabon, David [mailto:david_rabon@fws.gov]
Sent: Wednesday, April 24, 2013 06:10 AM
To: Leopoldo Miranda <leopoldo_miranda@fws.gov>
Cc: Janet Mizzi <janet_mizzi@fws.gov>; Jack Arnold <jack_arnold@fws.gov>; Kelly Bibb <kelly_bibb@fws.gov>; Jeffrey Fleming <jeffrey_m_fleming@fws.gov>
Subject: Re: Fw: Removal of Red Wolves

Hi Leo:

Sorry for the delay in responding.

You are correct in that the rule didn't adequately define or address the difference between a problem wolf and a non-problem wolf. From what I understand, the thinking at the time the rule was published was that landowners wouldn't call asking for removal of wolves if the wolves weren't causing a problem. Also, remember that this was a time before coyotes were well established in the recovery area. I think shortly after the rule was published the field program staff realized that rule created potential for conflict with the expanding coyote population and wolves being blamed for the actions of coyotes, and the potential for being overwhelmed with request for removing wolves as a result of misidentification or even as a loophole in the rule

We experienced a similar request from another landowner in 1996. We denied removing the wolves and quoted the harassment clause of the rule as an option to address the landowner's concerns. We were later given a NOI on this and other issues. Former RD Clough wrote a response addressing the claims of the NOI, but she did not specifically address the removal of wolves from private lands. Rather, it appears that she addressed the issue by stating:

"The Service's regulation concerning take of red wolves differs from North Carolina law in a number of minor ways. The North Carolina law can be described as being less restrictive than the red wolf regulation. It is the Service's position that if the North Carolina law is less restrictive, then the Federal regulation has primacy. We disagree with your contention that enforcement of the red wolf regulation is unconstitutional."

It appears from what little information I have in the files that the conversation over the issue of defining problem versus non-problem wolves and the appropriateness of removing wolves from private property at the landowner's request continued internally. I read through the correspondence between the former red wolf field coordinator (Brian Kelly) and the former red wolf recovery coordinator (Gary Henry). This correspondence ultimately led to the development of the Guidelines (dated January 1999) that I referenced in my draft letter. I do not know how widely distributed these guidelines made to the public or to the NCWRC. It appears, however, that our implementation of this policy sufficed in requests to remove wolves until Mr. [redacted] began his requests around 2008.

It is confusing, mainly because the language in the rule is ambiguous. Several of the sentences seem out of place, especially as they are being interpreted in this case. One could read each sentence literally and independently, in which case it could be read that we will remove any and all wolves, if possible, at the landowner's request. Alternatively, it could be read in the context of the paragraph that only wolves exhibiting behavioral problems or in need of special/medical attention would be removed. I think the guidelines attempted to clarify that by defining problem versus non-problem wolves.

Best,
David

On Wed, Apr 24, 2013 at 6:53 AM, Leopoldo Miranda <leopoldo_miranda@fws.gov> wrote:

Question. How public are the 1999 guidelines? I have not heard Gordon ever mentioning these so I think they don't know much about them. And I don't think the landowner knows about them either. David? I'll ask Mallory today also.. He is here at SERPPAS.

Now that I re read the language I see some potential conflicts between the rule and the guidelines. I'm sure we will get some "heat" because of this. Maybe it is just me that don't understand it well but it is confusing....

Leo

From: Leopoldo Miranda [mailto:leopoldo_miranda@fws.gov]
Sent: Tuesday, April 23, 2013 07:56 PM
To: 'janet_mizzi@fws.gov' <janet_mizzi@fws.gov>
Cc: 'jack_arnold@fws.gov' <jack_arnold@fws.gov>; 'david_rabon@fws.gov' <david_rabon@fws.gov>; 'kelly_bibb@fws.gov' <kelly_bibb@fws.gov>
Subject: Re: Fw: Removal of Red Wolves

So, the key here is the definition of a problem wolf. If it is not affecting personal property or the wolf is exhibiting inappropriate behavior the "authorization" to "take" a wolf will not be granted. Correct?

From: Mizzi, Janet [mailto:janet_mizzi@fws.gov]
Sent: Tuesday, April 23, 2013 01:49 PM
To: Leopoldo Miranda <leopoldo_miranda@fws.gov>
Cc: Jack Arnold <jack_arnold@fws.gov>; David Rabon <david_rabon@fws.gov>; Kelly Bibb <kelly_bibb@fws.gov>
Subject: Re: Fw: Removal of Red Wolves

Leo, we've been working with David and Darwin in LE on this quite a bit this afternoon. Here is the language as it appears directly in the rule and in our 1999 Guidelines for implementation of removal of problem wolves:

1. Any private landowner, or any other individual may take a red wolf found on his or her property within the areas identified above when the wolf is in the act of killing livestock or pets, provided that freshly wounded or killed livestock or pets are evident and that all such taking is reported within 24 hours to the Alligator River National Wildlife Refuge manager, or the State wildlife enforcement officer.

2. Any private landowner, or any other individual having his or her permission, may harass (for example, scare them off with loud noises like gunshots) red wolves found on his or her property in the areas identified above, provided that all such harassment is by methods that are not lethal or physically injurious to the red wolf and that all such taking is reported within 24 hours to the Alligator River National Wildlife Refuge manager, or the State wildlife enforcement officer.

3. Any private landowner may take red wolves found on his or her property in the areas defined above after efforts by project personnel to capture such individual wolf have been abandoned, provided that the Service project leader or biologist has approved such actions in writing and all such taking is reported within 24 hours to the Alligator River National Wildlife Refuge manager, or the State wildlife enforcement officer.

UnUnder the current version of the rule (50 C.F.R. § 17.84(c)(10), part (10) states:

> "The reintroduced populations will be monitored closely for the duration of the project, generally using radio telemetry as appropriate. All animals released or captured will be vaccinated against diseases prevalent in canids prior to release. Any animal that is determined to be in need of special care or that moves onto lands where the landowner requests their removal will be recaptured, if possible, by Service and/or Park Service and/or designated State wildlife agency personnel and will be given appropriate care. Such animals will be released back into the wild as soon as possible, unless physical or behavioral problems make it necessary to return the animals to a captive-breeding facility."

Shortly after the rule was published, we recognized several potential issues that conflict with our ability to recover the red wolf. These issues include (1) the definition of a "problem" wolf was not clear; (2) we are required to attempt to honor all requests to remove wolves from private lands whether an actual problem exists or not; (3) honoring all requests for removal could result on a significant drain on staffing and funding; (4) with an estimated red wolf population of 100 individuals, the tendency of wolves to travel long distances, territoriality, the mixture of land

ownership, and costs in staffing and funds, it is not possible to recapture, remove, and keep wolves off a specific tract of land; and, (5) the removal of non-problem wolves is in direct opposition to our efforts to recover the red wolf because removal prevents the natural expansion and recovery of the red wolf, contributes to the establishment of non-native coyotes and thus to hybridization between the two species, and it diverts resources from activities beneficial to the recovery under our current work plan. As such, we developed specific guidelines (policy dated January 28, 1999) to address requests to remove red wolves from private lands. The policy states:

REMOVAL OF WOLVES THAT ARE NOT CAUSING A PROBLEM

A "problem" wolf with respect to the potential issuance of written permission for a landowner to take a red wolf is defined as:

1. Any situation where the loss of personal property (e.g. livestock, pets) is directly caused by the actions of a red wolf, or

2. A wolf exhibiting inappropriate behavior, such as tolerance of people or dwellings, which suggests it may become a more serious problem.

Guidelines:

When a report of a red wolf caused problem is received, field personnel will respond within 48 hours. Field personnel will attempt to determine if a wolf is indeed responsible for the reported problem. If so, the capture and removal of the offending animal, or the application of some behavioral modification technique, may be attempted. If capture is not successful or feasible, lethal means could be employed or written permission may be provided according to the specifications provided in the current red wolf rule.

Justification:

The current red wolf rule articulates our required response and the potential for granting written permission to take depredating (definition #1 above) wolves. The use of behavioral modification is a non-lethal means by which certain problems related to undesirable behaviors (definition #2 above) may be resolved.

REMOVAL OF WOLVES THAT ARE NOT CAUSING A PROBLEM

Guidelines:

When a request is received to remove non-problem wolves, the red wolf field crew will respond, if manpower permits, to the landowner's request, to assess the situation and determine if efforts to capture such wolves are warranted. Traps may or may not be set to attempt to capture non-problem wolves. The criteria upon which this decision will be made include: the history of any problems in the area in question, available manpower, presence of wolf or other wild canid sign (feces, tracks), the history of wolf or other canid presence in the area in question, and the known presence of a wolf or other wild canid in the area based on radio telemetry data.

Justification:

The section of the red wolf rule that applies to these types of requests specifies we will recapture such wolves "if possible." While it may be possible to capture certain individuals, given the size and fluidity of the red wolf population 26 years after initial reintroductions, it is not possible to recapture, remove, and keep these wolves off of a specific tract of land. Because the current red wolf rule requires the release of non-problem wolves as soon as possible, the removed wolves, or other wolves, will often reoccupy the land in question. Also, the more a wolf is trapped the more trap wary that wolf becomes. Thus, in some cases, it may not be possible to capture certain individuals. Furthermore, removal of non-problem wolves may be contributing to the establishment of coyotes in northeastern North Carolina, thus such removals may have a detrimental effect on red wolf recovery efforts by increasing the threat of hybridization.

My advise is that we not give a yes or no answer to Mr. [redacted] ie., don't acknowledge the ultimatum. Rather, offer to meet with him yourself, as soon as possible. Draft language for your response to that effect is below, along with the actual rule language that is cited in that draft letter David provided you. Did you ever hear back from Gordon Meyers on your request for assistance with this? The history on this property would suggest that if we remove these wolves, others will just move into this territory. Hearing this from you could reinforce the message David has been sending. My understanding is that he has not provided any evidence of predation, which is required by the rule. See below.

Mr. [redacted] I appreciate the correspondence you sent this morning related to red wolves on your property. In response to your inquiry, I would like to come out and sit down with you in person and discuss your concerns. Can we do this the first week of May?

In the past, we have been able to assist and work in collaboration with you on your property in accordance with our existing regulation. For example:

In 2004, upon notification by you, that you had documentation of a red wolf depredating owned livestock, the Red Wolf Recovery Coordinator gave permission in accordance with the existing regulation to take this individual.

In 2007, we did remove one individual from your property in accordance with our regulation and at your request. The individual was moved 20 miles south. We understand this territory remained vacant for a few months and was reoccupied recently by red wolves.

We would like to continue to do so. I respectfully request that you not take further action until we can discuss this matter more thoroughly and in person at your earliest convenience.

On Tue, Apr 23, 2013 at 11:56 AM, Leopoldo Miranda <leopoldo_miranda@fws.gov> wrote:

Janet,

Could you help me answer these questions? I know the answer is "no" and the background info he provided is very selective.

Leo

From: [redacted] [mailto:[redacted]aol.com]
Sent: Tuesday, April 23, 2013 08:16 AM
To: leopoldo_miranda@fws.gov <leopoldo_miranda@fws.gov>
Cc: David_Viker@fws.gov <David_Viker@fws.gov>; jack_arnold@fws.gov <jack_arnold@fws.gov>; david_rabon@fws.gov <david_rabon@fws.gov>; gordon.myers@ncwildlife.org <gordon.myers@ncwildlife.org>; mallory.martin@ncwildlife.org <mallory.martin@ncwildlife.org>; danwoody@bellsouth.net

<danwoody@bellsouth.net>; jrprewitt007@gmail.com <jrprewitt007@gmail.com>; tanner@qdma.com <tanner@qdma.com>; tvingraham@aol.com <tvingraham@aol.com>; Trudy.Wade@ncleg.net <Trudy.Wade@ncleg.net>; Tommy.Tucker@ncleg.net <Tommy.Tucker@ncleg.net>; Mike.Woodard@ncleg.net <Mike.Woodard@ncleg.net>; Michael.Walters@ncleg.net <Michael.Walters@ncleg.net>; Josh.Stein@ncleg.net <Josh.Stein@ncleg.net>; Dan.Soucek@ncleg.net <Dan.Soucek@ncleg.net>; Jerry.Tillman@ncleg.net <Jerry.Tillman@ncleg.net>; Jeff.Tarte@ncleg.net <Jeff.Tarte@ncleg.net>; Gene.McLaurin@ncleg.net <Gene.McLaurin@ncleg.net>; Wesley.Meredith@ncleg.net <Wesley.Meredith@ncleg.net>; Martin.Nesbitt@ncleg.net <Martin.Nesbitt@ncleg.net>; Buck.Newton@ncleg.net <Buck.Newton@ncleg.net>; Brent.Jackson@ncleg.net <Brent.Jackson@ncleg.net>; Clark.Jenkins@ncleg.net <Clark.Jenkins@ncleg.net>; Eleanor.Kinnaird@ncleg.net <Eleanor.Kinnaird@ncleg.net>; Floyd.McKissick@ncleg.net <Floyd.McKissick@ncleg.net>; Shirley.Randleman@ncleg.net <Shirley.Randleman@ncleg.net>; Gladys.Robinson@ncleg.net <Gladys.Robinson@ncleg.net>; Bob.Rucho@ncleg.net <Bob.Rucho@ncleg.net>; Norman.Sanderson@ncleg.net <Norman.Sanderson@ncleg.net>; Earline.Parmon@ncleg.net <Earline.Parmon@ncleg.net>; Louis.Pate@ncleg.net <Louis.Pate@ncleg.net>; Ronald.Rabin@ncleg.net <Ronald.Rabin@ncleg.net>; Bill.Rabon@ncleg.net <Bill.Rabon@ncleg.net>; Jim.Davis@ncleg.net <Jim.Davis@ncleg.net>; Don.Davis@ncleg.net <Don.Davis@ncleg.net>; Warren.Daniel@ncleg.net <Warren.Daniel@ncleg.net>; David.Curtis@ncleg.net <David.Curtis@ncleg.net>; Bill.Cook@ncleg.net <Bill.Cook@ncleg.net>; Daniel.Clodfelter@ncleg.net <Daniel.Clodfelter@ncleg.net>; Ben.Clark@ncleg.net <Ben.Clark@ncleg.net>; Peter.Brunstetter@ncleg.net <Peter.Brunstetter@ncleg.net>; Neal.Hunt@ncleg.net <Neal.Hunt@ncleg.net>; Ralph.Hise@ncleg.net <Ralph.Hise@ncleg.net>; Fletcher.Hartsell@ncleg.net <Fletcher.Hartsell@ncleg.net>; Kathy.Harrington@ncleg.net <Kathy.Harrington@ncleg.net>; Rick.Gunn@ncleg.net <Rick.Gunn@ncleg.net>; Malcolm.Graham@ncleg.net <Malcolm.Graham@ncleg.net>; Thom.Goolsby@ncleg.net <Thom.Goolsby@ncleg.net>; Joel.Ford@ncleg.net <Joel.Ford@ncleg.net>; Austin.Allran@ncleg.net <Austin.Allran@ncleg.net>; Andrew.Brock@ncleg.net <Andrew.Brock@ncleg.net>; Harry.Brown@ncleg.net <Harry.Brown@ncleg.net>; Stan.Bingham@ncleg.net <Stan.Bingham@ncleg.net>; DanBlue@ncleg.net <DanBlue@ncleg.net>; Tamara.Barringer@ncleg.net <Tamara.Barringer@ncleg.net>; Phil.Berger@ncleg.net <Phil.Berger@ncleg.net>; Tom.Apodaca@ncleg.net <Tom.Apodaca@ncleg.net>; Chad.Barefoot@ncleg.net <Chad.Barefoot@ncleg.net>; Jeffrey.Elmore@ncleg.net <Jeffrey.Elmore@ncleg.net>; Beverly.Earle@ncleg.net <Beverly.Earle@ncleg.net>; Nelson.Dollar@ncleg.net <Nelson.Dollar@ncleg.net>; Jerry.Dockham@ncleg.net <Jerry.Dockham@ncleg.net>; Josh.Dobson@ncleg.net <Josh.Dobson@ncleg.net>; Jimmy.Dixon@ncleg.net <Jimmy.Dixon@ncleg.net>; Ted.Davis@ncleg.net <Ted.Davis@ncleg.net>; Leo.Daughtry@ncleg.net <Leo.Daughtry@ncleg.net>; Carla.Cunningham@ncleg.net <Carla.Cunningham@ncleg.net>; Tricia.Cotham@ncleg.net <Tricia.Cotham@ncleg.net>; Debra.Conrad@ncleg.net <Debra.Conrad@ncleg.net>; Jeff.Collins@ncleg.net <Jeff.Collins@ncleg.net>; George.Cleveland@ncleg.net <George.Cleveland@ncleg.net>; Rick.Catlin@ncleg.net <Rick.Catlin@ncleg.net>; Becky.Carney@ncleg.net <Becky.Carney@ncleg.net>; Justin.Burr@ncleg.net <Justin.Burr@ncleg.net>; Duane.Hall@ncleg.net <Duane.Hall@ncleg.net>; Larry.Hall@ncleg.net <Larry.Hall@ncleg.net>; George.Graham@ncleg.net <George.Graham@ncleg.net>; Mike.Hager@ncleg.net <Mike.Hager@ncleg.net>; Ken.Goodman@ncleg.net <Ken.Goodman@ncleg.net>; Charles.Graham@ncleg.net <Charles.Graham@ncleg.net>; Mitch.Gillespie@ncleg.net <Mitch.Gillespie@ncleg.net>; Rick.Glazier@ncleg.net <Rick.Glazier@ncleg.net>; Jim.Fulghum@ncleg.net <Jim.Fulghum@ncleg.net>; Rosa.Gill@ncleg.net <Rosa.Gill@ncleg.net>; Carl.Floyd@ncleg.net <Carl.Floyd@ncleg.net>; Valerie.Foushee@ncleg.net <Valerie.Foushee@ncleg.net>; Susan.Fisher@ncleg.net <Susan.Fisher@ncleg.net>; Elmer.Floyd@ncleg.net <Elmer.Floyd@ncleg.net>; John.Faircloth@ncleg.net <John.Faircloth@ncleg.net>; Jean.Farmer-Butterfield@ncleg.net <Jean.Farmer-Butterfield@ncleg.net>; Alma.Adams@ncleg.net <Alma.Adams@ncleg.net>; Dean.Arp@ncleg.net <Dean.Arp@ncleg.net>; Kelly.Alexander@ncleg.net <Kelly.Alexander@ncleg.net>; Brian.Brown@ncleg.net <Brian.Brown@ncleg.net>; Rayne.Brown@ncleg.net <Rayne.Brown@ncleg.net>; Rob.Bryan@ncleg.net <Rob.Bryan@ncleg.net>; Dana.Bumgardner@ncleg.net <Dana.Bumgardner@ncleg.net>; Robert.Brawley@ncleg.net <Robert.Brawley@ncleg.net>; William.Brawley@ncleg.net <William.Brawley@ncleg.net>; William.Brisson@ncleg.net <William.Brisson@ncleg.net>; Mark.Brody@ncleg.net <Mark.Brody@ncleg.net>; Hugh.Blackwell@ncleg.net <Hugh.Blackwell@ncleg.net>; John.Blust@ncleg.net <John.Blust@ncleg.net>; James.Boles@ncleg.net <James.Boles@ncleg.net>; Marcus.Brandon@ncleg.net <Marcus.Brandon@ncleg.net>; Marilyn.Avila@ncleg.net <Marilyn.Avila@ncleg.net>; Nathan.Baskerville@ncleg.net <Nathan.Baskerville@ncleg.net>; John.Bell@ncleg.net <John.Bell@ncleg.net>; Larry.Bell@ncleg.net <Larry.Bell@ncleg.net>; Stephen.Ross@ncleg.net <Stephen.Ross@ncleg.net>; Deborah.Ross@ncleg.net <Deborah.Ross@ncleg.net>; Dennis.Riddell@ncleg.net <Dennis.Riddell@ncleg.net>; Nathan.Ramsey@ncleg.net <Nathan.Ramsey@ncleg.net>; Mitchell.Setzer@ncleg.net <Mitchell.Setzer@ncleg.net>; Jacqueline.Schaffer@ncleg.net <Jacqueline.Schaffer@ncleg.net>; Ruth.Samuelson@ncleg.net <Ruth.Samuelson@ncleg.net>; Jason.Saine@ncleg.net <Jason.Saine@ncleg.net>; Tom.Murry@ncleg.net <Tom.Murry@ncleg.net>; Tim.Moore@ncleg.net <Tim.Moore@ncleg.net>; Rodney.Moore@ncleg.net <Rodney.Moore@ncleg.net>; Tim.Moffitt@ncleg.net <Tim.Moffitt@ncleg.net>; Joe.Queen@ncleg.net <Joe.Queen@ncleg.net>; Michele.Presnell@ncleg.net <Michele.Presnell@ncleg.net>; Larry.Pittman@ncleg.net <Larry.Pittman@ncleg.net>; Garland.Pierce@ncleg.net <Garland.Pierce@ncleg.net>; Paul.Tine@ncleg.net <Paul.Tine@ncleg.net>; Joe.Tolson@ncleg.net <Joe.Tolson@ncleg.net>; Evelyn.Terry@ncleg.net <Evelyn.Terry@ncleg.net>; Thom.Tillis@ncleg.net <Thom.Tillis@ncleg.net>; Ken.Waddell@ncleg.net <Ken.Waddell@ncleg.net>; Harry.Warren@ncleg.net <Harry.Warren@ncleg.net>; John.Torbett@ncleg.net <John.Torbett@ncleg.net>; Rena.Turner@ncleg.net <Rena.Turner@ncleg.net>; Paul.Stam@ncleg.net <Paul.Stam@ncleg.net>; Edgar.Starnes@ncleg.net <Edgar.Starnes@ncleg.net>; Phil.Shepard@ncleg.net <Phil.Shepard@ncleg.net>; Michael.Speciale@ncleg.net <Michael.Speciale@ncleg.net>; Mike.Stone@ncleg.net <Mike.Stone@ncleg.net>; John.Szoka@ncleg.net <John.Szoka@ncleg.net>; Bob.Steinburg@ncleg.net <Bob.Steinburg@ncleg.net>; Sarah.Stevens@ncleg.net <Sarah.Stevens@ncleg.net>; Julia.Howard@ncleg.net <Julia.Howard@ncleg.net>; Craig.Horn@ncleg.net <Craig.Horn@ncleg.net>; Frank.Iler@ncleg.net <Frank.Iler@ncleg.net>; Pat.Hurley@ncleg.net <Pat.Hurley@ncleg.net>; Darren.Jackson@ncleg.net <Darren.Jackson@ncleg.net>; Verla.Insko@ncleg.net <Verla.Insko@ncleg.net>; Linda.Johnson@ncleg.net <Linda.Johnson@ncleg.net>; Charles.Jeter@ncleg.net <Charles.Jeter@ncleg.net>; Edward.Hanes@ncleg.net <Edward.Hanes@ncleg.net>; Susi.Hamilton@ncleg.net <Susi.Hamilton@ncleg.net>; Pricey.Harrison@ncleg.net <Pricey.Harrison@ncleg.net>; Jon.Hardister@ncleg.net <Jon.Hardister@ncleg.net>; Yvonne.Holly@ncleg.net <Yvonne.Holly@ncleg.net>; Kelly.Hastings@ncleg.net <Kelly.Hastings@ncleg.net>; Bryan.Holloway@ncleg.net <Bryan.Holloway@ncleg.net>; Mark.Hollo@ncleg.net <Mark.Hollo@ncleg.net>; Susan.Martin@ncleg.net <Susan.Martin@ncleg.net>; Pat.McElraft@ncleg.net <Pat.McElraft@ncleg.net>; Chuck.McGrady@ncleg.net <Chuck.McGrady@ncleg.net>; Deb.McManus@ncleg.net <Deb.McManus@ncleg.net>; Allen.McNeill@ncleg.net <Allen.McNeill@ncleg.net>; Mickey.Michaux@ncleg.net <Mickey.Michaux@ncleg.net>; Chris.Millis@ncleg.net <Chris.Millis@ncleg.net>; Annie.Mobley@ncleg.net <Annie.Mobley@ncleg.net>; Bert.Jones@ncleg.net <Bert.Jones@ncleg.net>; Johnathan.Jordan@ncleg.net <Johnathan.Jordan@ncleg.net>; Donny.Lambeth@ncleg.net <Donny.Lambeth@ncleg.net>; James.Langdon@ncleg.net <James.Langdon@ncleg.net>; David.Lewis@ncleg.net <David.Lewis@ncleg.net>; Marvin.Lucas@ncleg.net <Marvin.Lucas@ncleg.net>; Paul.Luebke@ncleg.net <Paul.Luebke@ncleg.net>; Chris.Malone@ncleg.net <Chris.Malone@ncleg.net>; Michael.Wray@ncleg.net <Michael.Wray@ncleg.net>; Chris.Whitmire@ncleg.net <Chris.Whitmire@ncleg.net>; Winkie.Wilkins@ncleg.net <Winkie.Wilkins@ncleg.net>; Andy.Wells@ncleg.net <Andy.Wells@ncleg.net>; Roger.West@ncleg.net <Roger.West@ncleg.net>; mitchstclair@suddenlink.net <mitchstclair@suddenlink.net>; dslaughi@aol.com <dslaughi@aol.com>; coley@bpropnc.com <coley@bpropnc.com>; tom.berry@berico.com <tom.berry@berico.com>; johnc@sboil.com <johnc@sboil.com>; garry.spence@ncwildlife.org <garry.spence@ncwildlife.org>; Richard.edwards@ncwildlife.org <Richard.edwards@ncwildlife.org>; davidwhoylejr@gmail.com <davidwhoylejr@gmail.com>; ray.clifton@ncwildlife.org <ray.clifton@ncwildlife.org>; wes@seegarsfence.com <wes@seegarsfence.com>; joe@enceechemical.com <joe@enceechemical.com>; rwhite@mindspring.com <rwhite@mindspring.com>; BSkinner3@aol.com <BSkinner3@aol.com>; hayden.rogers@ncwildlife.org <hayden.rogers@ncwildlife.org>; druffin@triad.rr.com <druffin@triad.rr.com>; jcogdell@forkstables.com <jcogdell@forkstables.com>; c.willis@tyrrellcounty.net <c.willis@tyrrellcounty.net>; n.everett@tyrrellcounty.net <n.everett@tyrrellcounty.net>; l.hill@tyrrellcounty.net <l.hill@tyrrellcounty.net>; l.spivey@tyrrellcounty.net <l.spivey@tyrrellcounty.net>; thomassp@earthlink.net <thomassp@earthlink.net>; sextonfarms@embarqmail.com <sextonfarms@embarqmail.com>; d.colephelps@gmail.com <d.colephelps@gmail.com>; rmac18@hotmail.com <rmac18@hotmail.com>; manningfarms@gotricounty.com <manningfarms@gotricounty.com>; traceyj204@gmail.com <traceyj204@gmail.com>; vtillett@darenc.com <vtillett@darenc.com>; allenb@darenc.com <allenb@darenc.com>; jshea@darenc.com <jshea@darenc.com>; maxd@darenc.com <maxd@darenc.com>; richardj@darenc.com <richardj@darenc.com>; warren@darenc.com <warren@darenc.com>; Woodard@darenc.com <Woodard@darenc.com>; hrichardsonpa@embarqmail.com <hrichardsonpa@embarqmail.com>; langleyspeak@suddenlink.net <langleyspeak@suddenlink.net>; 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Subject: Re: Removal of Red Wolves

Mr. Miranda,

For over 10 years I have demanded the removal of your wolves from our property. Not once has USFWS complied in the

manner described in the attached 1995 rules revisions. We, better than anyone, understand the "dynamics" of the red wolf population on our management goals for our property and we want your wolves gone. The choice of having a nonessential experimental wolf on our property is our choice and has nothing to do with your or the alleged "public's conservation goals".

The solution to "our" problem has been in place for 18 years! Our specific problem was clearly addressed in the 1995 Revision of the Special Rule for Nonessential Experimental Populations of Red Wolves in North Carolina and Tennessee. I will try to make our position painfully clear by asking you to give us a one word yes or no answer to two basic questions. Text from the attached 1995 rules revision document will be quoted to provide guidance for your answers.

Question One: Will you remove your wolves from our property as we have repeatedly requested?

Guidance:
1. "Therefore, the special rule is modified to provide that **all landowner requests** to remove wolves from their property **will be honored**"

2. "Any animal that is determined to be in need of special care or that moves onto lands where the landowner requests their removal **will be recaptured"**

Answer: Yes or No

Question Two: Since you have been unwilling and/or unable to remove your wolves from our property, will you permit us to remove them ourselves?

Guidance:
1. "(v) Any private landowner may take red wolves found on his or her property in the areas defined in paragraphs (c)(9) (i) and (ii) of this section after efforts by project personnel to capture such animals have been abandoned, Provided that the Service project leader or biologist has approved such actions in writing

2. "Notification would allow the Service to remove the offending animals, which are still valuable to the recovery objectives as breeding animals. If unsuccessful in removing the animals, the Service will permit the landowner to take action to remove any returning animals"

Answer: Yes or No

If you had difficulty in answering these questions, I will provide you with two parting pieces of guidance:

1. "programs to purposely reintroduce predators, such as the red wolf, must be accompanied by provisions to protect private property from the presence of such reintroduced animals if the landowner does not want them on his property. Such protection is necessary in order to obtain local public support, which is essential to success. Without such support, reintroductions are doomed, because the animals can be efficiently eliminated, as evidenced by past history."

2. "although some expressed concern about the effect of red wolves on activities on private land. The Service assured them that, because free-ranging wolves are legally classified as members of an experimental nonessential population, the wolves would not negatively impact legal activities on private or Federal land"

Please provide us with yes or no answers to the above questions no later than 5:00 pm on 4/23/13. **Your refusal to honor our above requests to remove your wolves from our property amounts to a government take of private lands for your intended purposes.** We are asking our representatives charged with the duty of protecting our constitutional rights to please step in and force you to comply with the rules you helped write and agreed to in exchange for the expansion and continuation of your nonessential experimental program. We are asking that the NCWRC step in and honor their mission statement: "To conserve North Carolina's wildlife resources and their habitats and provide programs and opportunities that allow hunters, anglers, boaters; other outdoor enthusiasts to enjoy wildlife-associated recreation." Red wolves and now rampant hybridization of red wolves and coyotes have destroyed our farm for our intended purposes. No longer are our families able to enjoy this incredible dream we once had.

Sincerely,
[redacted] (252) 714-2774
[redacted]

Re: Removal of Red Wolves
From: Miranda, Leopoldo <leopoldo_miranda@fws.gov>
To: [redacted] <[redacted]aol.com>
Cc: Gordon S. Myers <gordon.myers@ncwildlife.org>; mallory.martin <mallory.martin@ncwildlife.org>; David Rabon <david_rabon@fws.gov>; David Viker <David_Viker@fws.gov>; Jack Arnold <jack_arnold@fws.gov>
Date: Fri, Apr 19, 2013 7:05 pm

Dear Mr. [redacted]
First of all let me introduce myself. I'm Leo Miranda and I serve as the Assistant Regional Director for Ecological Services in our agency's Southeast Regional Office located in Atlanta. I am responsible for the implementation and management of the Endangered Species Act and the Red Wolf Recovery Program.
I am personally coordinating with Gordon Myers at the North Carolina Wildlife Resources Commission, his staff in Raleigh and our Red Wolf Recovery Program staff led by David Rabon in an effort to try to find a solution to your concerns. In fact, I asked David for an opportunity to provide feedback to the letter he was drafting to send to you after the meeting that was held March 22, 2013, at NCWRC offices in Raleigh. I apologize and take full responsibility for the delay in getting a response to you as we intended. That's on me, not David.
I am a strong believer that the conservation of species including the Red Wolf is compatible with the wildlife and habitat management goals of private landowners. In fact, I've dedicated large parts of my career to working with private lands conservation programs across the nation. I have been exploring and discussing with NCWRC and my staff in North Carolina several potential ideas that may be of interest to you in trying to find a long-term solution to the issues you have raised related to the Red Wolves using your property. It is my understanding that several Red Wolves have been removed from your property in the past and that they have either returned or the area has been re-occupied by other wolves soon after they were removed.
Removing individual wolves from your property is not a long-term solution. I think that if we work together we may be able to understand the population dynamics across the landscape and be able to manage the wolf population in a way that meets both your management goals as a private landowner and the public's conservation goals for the species recovery. If you and your fellow landowners are willing, I think together we can develop a management plan for your property and surrounding areas that incorporates research to understand the population dynamics of Red Wolves as well as direct habitat management actions that may benefit other wildlife resources within your property.
I apologize once again for the delay and I want to assure you this is a top priority for us. If you have any questions, please call me directly at 404-679-7085, and my email is Leopoldo_Miranda@fws.gov.
Sincerely,
Leo

Leopoldo "Leo" Miranda
U.S. Fish and Wildlife Service
Assistant Regional Director, Ecological Services
Southeast U.S., Puerto Rico and U.S. Virgin Islands
1875 Century Boulevard
Atlanta, GA 30345
1-404-679-7085 (phone)
1-404-353-6448 (Blackberry)
1-404-679-7081 (fax)
Leopoldo_Miranda@fws.gov

Re: Removal of Red Wolves
From: David Rabon <david_rabon@fws.gov>
To: [redacted] <[redacted]aol.com>
Cc: Leopoldo Miranda <Leopoldo_Miranda@fws.gov>
Date: Thu, Apr 18, 2013 7:57 pm
Dear Mr. [redacted]

Thank you for your email. I continue to work closely with my Assistant Regional Director, Leopoldo Miranda, in finding a solution. We are in the process of finalizing a response to your request.

Sincerely,
David

David R. Rabon, Jr., PhD
Coordinator, Red Wolf Recovery Program
U.S. Fish and Wildlife Service
Post Office Box 1969
Manteo, North Carolina 27954

telephone: 252.473.1132 x 240
telefax: 252.473.4836
email: david_rabon@fws.gov

website: www.fws.gov/redwolf
Facebook: www.facebook.com/redwolfrecoveryprogram
blog: trackthepack.blogspot.com
Twitter: www.twitter.com/redwolfrecovery

From: [redacted] <[redacted]aol.com>
Date: April 18, 2013, 4:26:59 PM EDT

To: david_rabon@fws.gov
Cc: jrprewitt007@gmail.com, gordon.myers@ncwildlife.org, mallory.martin@ncwildlife.org, danwoody@bellsouth.net, larry.wooten@ncfb.org, henri@mccleesconsulting.com, dank@scsportsman.com, dick@ncwf.org, paul.tine@ncleg.net, bill.cook@ncleg.net, bill.daughtridge@doa.nc.gov, Phil.Berger@ncleg.net, clark.jenkins@ncleg.net, fblount@blountpetroleum.com, coley.bpropnc@gmail.com, davidwhoylejr@gmail.com, rwhite@mindspring.com, joe@enceechemical.com, wes@seegarsfence.com, ray.clifton@ncwildlife.org, jcogdell@forkstables.com, druffin@triad.rr.com, hayden.rogers@ncwildlife.org, BSkinner3@aol.com, mitchstclair@suddenlink.net, dslaughi@aol.com, Tom.berry@berico.com, johnc@sboil.com, garry.spence@ncwildlife.org, richard.edwards@ncwildlife.org, sruinsky@newsobserver.com, aclark@reflector.com, carolinawoodduck@aol.com, ncago@ncdoj.gov, aaron.decker@imoutdoors.com, fsletters@bonniercorp.com, olletters@bonniercorp.com, fcbsr@earthlink.net, fcbsr@verizon.net, Millie.Lilley@mail.house.gov, letters@sportsafield.com
Subject: Re: Removal of Red Wolves

David,

Your response is not acceptable. You as the Red Wolf Coordinator for the USFWS have failed to remove your wolves from our property upon our request (see attachment). You have also chosen not to respond to our request for us to remove the wolves ourselves (see below). When asked to bring the relevant wolf tracking and count information to our meeting with Gordon Myers, NCWRC Director, you refused. Your performance of the first two requests is mandated by the 1995 revisions to the Special Rule for Nonessential Experimental Populations of Red Wolves In North Carolina and Tennessee (50 CFR Part 17) see attachment. The continuance and expansion of the Red Wolf program was predicated upon these very revisions. You are in violation of the Endangered Species Act. You have put yourself and the Red Wolf program above the law. This is not acceptable and is the reason your program is loathed by so many. This law has been in place since 1995 and you are unwilling and/or unable to comply with a simple clause related to protecting private landowners from your experiment. This battle of removing your wolves from our property has persisted from the time of your predecessor, Bud Fazio, and continues now through you. Our patience, understanding and cooperation is now nonexistent. Again, your response is not acceptable and you are in violation of the law. The continual presence of your wolves on our property has decimated the wildlife population and has rendered our land useless for our intended purpose.

I have copied many others on this email to bring this matter to the public's attention before it is too late. Your wolves are expanding east to west. Coyotes have expanded west to east. They have now interbred and the result is a wolf/coyote hybrid. Now, the NCWRC has all but declared war on the coyote because of its adverse impact upon wildlife. You on the other hand are expanding and protecting wolves that breed with the coyotes (see attached NCWRC hybrid study map). To add fuel to the fire, you are currently collaring red wolves, coyotes and hybrids. You have also imposed a one year jail term and $100,000 fine for killing a red wolf. What is your punishment for your previously noted violations of this ACT? You have told hunters not to shoot coyotes east of Hwy 32 (see attachment). By your own admission all three species (coyotes, hybrids, red wolves) look alike. In fact DNA scientists have difficulty distinguishing the differences (see "wolf is 76% coyote" and genetic mess is "canis soup" attachments). So here we sit, if your program is successful, you have expanded wolves throughout NC and they have interbred and created a super coyote now capable of way more damage than a regular coyote, that no one can distinguish or kill because they can be put in jail for a year and fined $100,000. This is sheer stupidity. NC residents and sportsmen need to have a thorough understanding of these facts before our wildlife landscape is permanently damaged. We are afraid it is too late for our farm, but maybe this letter can protect others from what we have suffered.

Sincerely,

[redacted]

IGNORED LETTER

On March 22, you were hand delivered a request to remove your red wolves from our property in Tyrrell County. On March 26, you were sent a follow up email reiterating our request for the immediate removal of your wolves by April 5th. To date, you have made no attempt to provide to us, as private landowners, our protection allowed by law. This law furthermore allows private land owners the ability to remove your wolves from our property when your attempts fail or are abandoned. This is not the end result that we wanted, but you have left us with no other choice. You had the ability to recapture these wolve and use them in a captive breeding program as stipulated in the 1995 rules revision, yet you have chosen not to act to protect either the wolves or us. We are now asking permission, as provided by the law, for us to have these wolves removed ourselves. Your failure to act on this request will be taken as an affirmative reponse to this request.

Sincerely,

[redacted]

BISON CONNECT

Rabon, David <david_rabon@fws.gov>

(no subject)

5 messages

Beyer, Arthur <arthur_beyer@fws.gov> Fri, Apr 26, 2013 at 8:41 AM
To: David Rabon <david_rabon@fws.gov>, Rebecca Bartel <rebecca_bartel@fws.gov>

bad news - 1st 3 litters came back hybrid - total of 14 pups, including Tyson (bee tree). May use the 3 pups at camp to replace hers with. Maybe thats what happens when we catch a breeding male (at bee tree) during breeding season and release further away due to circumstances with a fucking landowner!

Found 2 others litters this week for 11 pups and looking at another 6 litters.

Rabon, David <david_rabon@fws.gov> Fri, Apr 26, 2013 at 9:12 AM
To: "Beyer, Arthur" <arthur_beyer@fws.gov>, Rebecca Bartel <rebecca_bartel@fws.gov>

Very bad news! I am going to wait for now until we have the results from the season, but I intend to give all of these updates to the RO to let them know what kind of issues this level of mortality and landowner issues are creating. If the RO moves on an issue before our season is over, then I will go ahead and provide what info we have.

Art, can you provide the details on these three litters? Name, number of pups, and any story behind what might have caused the hybrid event (e.g., loss of breeder, etc.). Thank you.

On Fri, Apr 26, 2013 at 8:41 AM, Beyer, Arthur <arthur_beyer@fws.gov> wrote:

> bad news - 1st 3 litters came back hybrid - total of 14 pups, including Tyson (bee tree). May use the 3 pups at camp to replace hers with. Maybe thats what happens when we catch a breeding male (at bee tree) during breeding season and release further away due to circumstances with a fucking landowner!
>
> Found 2 others litters this week for 11 pups and looking at another 6 litters.

--

David R. Rabon, Jr., PhD
Coordinator, Red Wolf Recovery Program
U.S. Fish and Wildlife Service
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blog: trackthepack.blogspot.com
Twitter: www.twitter.com/redwolfrecovery

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Rebecca Bartel <rebecca_bartel@fws.gov> Fri, Apr 26, 2013 at 9:15 AM
To: "Rabon, David" <david_rabon@fws.gov>
Cc: "Beyer, Arthur" <arthur_beyer@fws.gov>

Dammit. Thanks for the update. Hopefully we'll find more pure litters. Fostering the 3 survivors from Sandy Ridge is a good suggestion too. Hang in there, crew!

Sent from my iPhone
[Quoted text hidden]

Arthur Beyer <arthur_beyer@fws.gov> Fri, Apr 26, 2013 at 10:19 AM
To: "Rabon, David" <david_rabon@fws.gov>

Found one pup at Milltail, but only one left at sandy ridge, so I'm talking to will about pups from Jackson MS. I'll get u an update on the hybrid litters later.

On Apr 26, 2013, at 9:12 AM, "Rabon, David" <david_rabon@fws.gov> wrote:

[Quoted text hidden]

Arthur Beyer <arthur_beyer@fws.gov> Fri, Apr 26, 2013 at 10:31 AM
To: "Rabon, David" <david_rabon@fws.gov>

We did not have a male on the air at Beech Ridge but the same wolf sired a litter there for at least the last 2 or 3 years till now. Still have male yearling so doesn't look like another male moved in. Heard some grumblings in area bout too many wolves during trapping season this year, so most likely shot late in season and coyote slipped in. 6 pups from that litter.

Lux had 4 pups. Breeding male was shot there 2011 hunting season and didn't have any males there till 2 moved in this year, but looks like one ran off the other and paired with only one of 2 females, the other one with coyote

Not sure what happened at Tyson (4 pups), but male was older and the one that disappeared.

On Apr 26, 2013, at 9:12 AM, "Rabon, David" <david_rabon@fws.gov> wrote:

[Quoted text hidden]

Harrison, Rebecca <rebecca_harrison@fws.gov>

Re: pics from today

Rabon, David <david_rabon@fws.gov> Thu, Jun 20, 2013 at 1:47 PM
To: Leopoldo Miranda <leopoldo_miranda@fws.gov>
Cc: "kelly_bibb@fws.gov" <kelly_bibb@fws.gov>, "janet_mizzi@fws.gov" <janet_mizzi@fws.gov>, "jack_arnold@fws.gov" <jack_arnold@fws.gov>, "jeffrey_m_fleming@fws.gov" <jeffrey_m_fleming@fws.gov>, "david_viker@fws.gov" <david_viker@fws.gov>, "mike_bryant@fws.gov" <mike_bryant@fws.gov>
Bcc: rebecca_bartel@fws.gov

Leo:

I'm trying to understand what our long-term, short-term objective is with this issue. I know that we did not start this exercise with the idea that it would be sustainable. But I also know that one possible fix (i.e., rule change) is at least a year off in the distance. It seems we are fast approaching another decision point and I want to make sure I understand how to proceed. I also want to state that we haven't necessarily "done all we could" if the alternative is to authorize Mr. Ferebee to kill the remaining wolf.

First, we have trapped Mr. Ferebee's property for the three wolves that used a portion of his property as part of their territory. We caught two of them and have continued to hold them in captivity for about four weeks now. Our efforts at trapping the remaining wolf has been hampered in part by the weather (excessive rain and a tropical storm). But we have been equally plagued with large numbers of deer and bear setting off the traps, as well as having had a number of traps destroyed by farm equipment on Ferebee's property. These issues, in addition to the rising temperatures and the risks trapping poses to the wolves, are why we don't trap during the summer. Trapping is not without risks to the wolf, but it is our best option to get the animal with the least possibility of damage, and is done with the intent of continuing to use the wolves in the recovery effort.

Second is the issue of what do we do with the captured wolves. According to our rule, we should release them unless behavioral or physical problems require them to be "returned" to captivity. That is not the case with either of these two animals, and I also noted that these two wolves were born and raised in the wild, not captivity. We are exploring areas to return these two wolves to the population, but as I have stated from the start there is the possibility that they will return to their territory on Pocosin Lakes NWR and use a portion of Ferebee's property. However, I don't think that possibility should be the sole reason we hold them indefinitely in captivity. Even if they don't return to his property, other wolves will likely move onto Mr. Ferebee's property. Which brings me to my third point.

We are seeing evidence that a coyote has moved on to Mr. Ferebee's property, and is possibly associating with the remaining male wolf there (although we can't be sure on either account). We also are seeing the wolf pack from the east move closer to Mr. Ferebee's than we have ever seen them before, probably in response to the removal of the breeding female from the pack that used Mr. Ferebee's property. We also are seeing two male wolves move down from the north toward Mr. Ferebee's property. The point being, that even if we remove the wolves that use(d) his property, there will be others that move into the area. How are we to deal with these animals now that we have set a precedence to remove wolves from his property?

This question brings me to the crux of the matter, and partly the reason for my email. Are we moving toward a decision to allow Mr. Ferebee to destroy any wolf that comes onto his property? If so, then he will likely have the opportunity to destroy more than the one wolf that remains from the pack that originally used his property. And this, in a very short time, could negatively affect a number of wolf packs in the area and, more importantly, greatly affect our abilities to conserve the red wolf. My concern is that we are at a point where our decisions are no longer just trying to appease an uncooperative landowner, but rather have the potential to change the course of this program away from its mission to recover the red wolf.

I want to offer a solution, one in which we progressively work through options with elevating risks to the animal, until a long-term solution can be put in place, and one that will keep us true to our mission to recover the red wolf. I want to do this as opposed to providing any authorization to the landowner because I want to preserve the opportunity to continue to use the animals for conservation and recovery and because I don't want to set a precedence for the future.

Currently, we have two options to remove the remaining wolf and potentially new wolves moving onto Mr. Ferebee's property. We can continue to trap, but this will subject the animal to possible heat stroke if conducted during the summer. We also can attempt to dart the remaining wolf. We don't typically dart animals because of the risks our equipment pose to the animal, and the terrain is not conducive to accurately and efficiently allow for that method of capture. Nevertheless, the risks to the animal are still less with trapping and darting than they are with an authorization for the landowner to kill the animal.

I would like to add that there is better equipment for darting than what we currently own. But we have not invested in it because it was rather pricey for an activity that we don't particularly care to use. However, if we are likely to be in a situation where we may have to use darting on a regular basis to deal with landowners wanting wolves removed from their property, then I would propose we purchase the new darting equipment. I believe the costs are between $3000 and $5000 for the equipment, but as I understand it, the new dart systems are much more reliable and controllable and would be worth the price to improve safety for the animal.

I would also suggest that we release as soon as possible any wolves trapped on Mr. Ferebee's property.. Maybe the release is on NWR lands or maybe on a cooperating landowner's property. We will take great care to select sites that will increase the likelihood of the wolves staying where they are released. Of course, we run the risk of them returning to his property, but our actions and continued presence there might also deter wolves from using his property. I would rather devote staffing resources to this action until we can correct a rule that would never allow such an activity to occur in the first place than lose more ground in the conservation of the red wolf and more wolves from the landscape. If we provide any kind of authorization that allows for the killing of wolves, then it could very easily affect at least three packs in a very short period of time. We currently only have 12 packs that are viable. The loss of three of them to this type of action would be detrimental to the population, and likely make the program unsustainable when coupled with our increasing levels of gunshot mortality.

Thank you for allowing me the opportunity to express my opinions and suggestions. I look forward to your response.

Best,
David

On Thu, Jun 20, 2013 at 8:01 AM, David Rabon <david_rabon@fws.gov> wrote:

> Hi Leo:
>
> When you say authorize Mr. Ferebee to take the wolf, do you mean in the form of harassment or to kill the animal?
>
> Thank you,
> David
>
> David R. Rabon, Jr., PhD
> Coordinator, Red Wolf Recovery Program
> U.S. Fish and Wildlife Service
> Post Office Box 1969
> Manteo, North Carolina 27954

telephone: 252.473.1132 x 240
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website: www.fws.gov/redwolf
Facebook: www.facebook.com/redwolfrecoveryprogram
blog: trackthepack.blogspot.com
Twitter: www.twitter.com/redwolfrecovery

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On Jun 20, 2013, at 7:26 AM, Leopoldo Miranda <leopoldo_miranda@fws.gov> wrote:

Let's start drafting a response to Mr Ferebee with the history of what we have done til' today since my meeting with him in Raleigh and since we started trapping these wolves.

Let's document that we have done all we could. Then add a "therefore" and use our rule's language to authorize him to take the wolf. There are some limitations in the rule that we need to make very clear.

I talked to Darwin and he said that we need to be as clear as possible.

Leo

From: Jett Ferebee [mailto:jettferebee@aol.com]
Sent: Wednesday, June 19, 2013 07:25 PM
To: leopoldo_miranda@fws.gov <leopoldo_miranda@fws.gov>
Subject: pics from today

Leo,
Do you have any news yet on your plans?
Thanks,
Jett

<mates.jpg>

--

David R. Rabon, Jr., PhD
Coordinator, Red Wolf Recovery Program
U.S. Fish and Wildlife Service
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telephone: 252.473.1132 x 240
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United States Department of the Interior

FISH AND WILDLIFE SERVICE
RED WOLF RECOVERY PROGRAM
Post Office Box 1969 / 100 Conservation Way
Manteo, North Carolina 27954

June 24, 2013

MEMORANDUM

To: David Rabon, Coordinator, Red Wolf Recovery Program

cc: Rebecca Bartel, Assistant Coordinator, Red Wolf Recovery Program

From: Art Beyer, Field Coordinator, Red Wolf Recovery Program

Subject: Update on capture efforts of red wolves on Bee Tree Farm in Tyrrell County, NC and plans for the release of two female wolves already captured.

This memo is to provide an update on our efforts to capture red wolves on Bee Tree Farms per Mr. Ferebee's request for removal, and a plan to release the two wolves captured to date and currently being held in pens on Alligator River NWR.

Approximately 30 traps were initially set on May 24, 2013, and two (both females) of the three collared wolves that use portions of Bee Tree Farms were captured on May 26. Traps were run until June 6 when they were pulled due to an approaching tropical storm and high temperatures. Due to continued rains and farming operations, traps were not reset until June 16. Because of increasing temperatures we have now pulled all traps on the farm. We will however look for darting opportunities when we locate the remaining male wolf on Mr. Ferebee's property. We have not made such attempts to date due to the inherent risks associated with darting, and also due to the older, less reliable equipment we have on hand. Once temperatures subside we will resume trapping efforts.

We are continuing to monitor the remaining male wolf which is occasionally located on Bee Tree Farms. This wolf is often located on refuge property to the southeast, possibly due to the increased level of farming activity in other areas of it's territory. Based on recent telemetry locations this wolf also appears to have paired with a collared, sterile female coyote that has moved into the area following our removal of the two resident female wolves.

The two female wolves captured in May have been held for a month now, much longer than we have held wolves in the past following the capture of wolves in response to a presence-only complaint. As required by our rule (50 CFR, Part 17.84 (c)(4)(10) "Any animal…that moves onto lands where the landowner requests their removal will be recaptured, if possible…Such animals **will be released back into the wild as soon as possible**, unless physical or behavioral problems make it necessary to return the animals to a captive-breeding facility") we are currently planning to release the younger female wolf in the next few weeks in a territory currently

inhabited by a male wolf in an effort to form a breeding pair. As the older female may have reached senescence we have not decided on a release location for her at this time.

BISON CONNECT

Harrison, Rebecca <rebecca_harrison@fws.gov>

Fwd: Two documents

Rabon, David <david_rabon@fws.gov> Tue, Dec 3, 2013 at 9:54 AM
To: Rebecca Bartel <rebecca_bartel@fws.gov>, Arthur Beyer <arthur_beyer@fws.gov>

Meant to include you on my email. This is just FYI so you know what I am providing to the RO in making our case.

Please keep close hold. And THANK YOU for tracking down this information for me to use.

Best,
David

---------- Forwarded message ----------
From: **Rabon, David** <david_rabon@fws.gov>
Date: Tue, Dec 3, 2013 at 9:52 AM
Subject: Re: Two documents
To: Leopoldo Miranda <leopoldo_miranda@fws.gov>
Cc: Jeffrey Fleming <jeffrey_m_fleming@fws.gov>, David Viker <david_viker@fws.gov>, Elizabeth Souheaver <elizabeth_souheaver@fws.gov>, Mike Bryant <Mike_Bryant@fws.gov>, Stacy Shelton <stacy_shelton@fws.gov>, Jack Arnold <jack_arnold@fws.gov>, Aaron Valenta <aaron_valenta@fws.gov>

Hi all:

Attached are a few documents to consider regarding the removal of wolves from private property at the landowners request. These show the progression of the conversation both internally (with Solicitor review and approval) and externally that resulted in the development and implementation of our 1999 Guidelines. We have been using these Guideline since then with a great deal of success.

There may be more documents, but these are a few that show this issue was fully considered and resolved in 1999.

The first document (19981123) is a memo from (former) Field Coordinator Kelly to RWRP staff discussing requests to remove non-problem wolves from private lands. The book chapter he references is likely the 2000 article by Kelly and Phillips that Leo sent a link to in his earlier email.

The second document (19981201) is a memo from (former) Field Coordinator Kelly to (former) Recovery Coordinator Henry, dated December 1998, discussing why a letter would not be issued to a private landowner to remove wolves and why our regulations may be contrary to our mission to recover the red wolf.

The third document (19990121) is a pre-meeting discussion paper provided to participants of a meeting to discuss red wolf regulations. The document clearly and comprehensively discusses the issues regarding the removal of wolves from private lands and considers options to address the issues. This document also shows that we had discussions with the WRC on this issue. Although, I don't have any specific documentation on who the Regional Solicitor was that participated, there is several references that they were involved in this meeting and/or in the development of the Guidelines.

The fourth document (19990128) is the Guidelines for Applying the Current Red Wolf Rule (April 13, 1995) to

Requests to Remove red wolves from private land. This is the Guidelines that we reference and the document by which we have handled requests for the removal of red wolves from private lands since 1999.

The fifth document (19990223) is a briefing paper for the Director on the status and significant issues regarding red wolf reintroduction. I don't know the author on this document, but the contact was the (former) Assistant Director, Ecological Services Gerry Jackson. This document reiterates that our Guidelines were developed with Solicitor input and approval and communicated as policy to the Director of the FWS.

The sixth document (19990315) is a memo from (former) Recovery Coordinator Henry to (former) State Supervisor Cole on the monthly activity report. In this document Henry notes he prepared a briefing statement entitled "Interpretation and Implementation of Red Wolf Regulations" to the Regional Director, but I cannot find this briefing paper. The briefing statement evidently summarized the results of the January (1999) meeting of Service personnel on the subject. He also notes that he prepared a draft memo, for RO signature, recognizing a member of the Regional Solicitor's Office for his assistance with the Red Wolf Program in the development of the Guidelines.

The seventh document (19990724) is an email from Mitch King (former DRD?) to Brian Kelly regarding a briefing paper prepared on the red wolf program. I cannot find the briefing paper, but his note references that implementation of the Guidelines appears to have resulted in little or no public issues (see statement "I particularly like the fact that it's quite (sic) on the current landowner/removal issue.").

The eight document (19991021) is a letter from the RWRP to Senator Marc Basnight) announcing three public open houses to discuss upcoming changes to the federal rule by which the Service manages red wolves. In this letter, we specifically state that the proposed changes will include:

1. Re-wording the current rule so it is clear that the Service will resolve situations where wolves are causing property damage (using lethal methods if necessary), and if the Service is not successful, we will grant landowners written permission to remove such wolves, and
2. The Service will no longer remove wolves when requested to do so by private landowners unless removing the wolves will resolve situations where wolves are causing property damage.

I cannot find any documentation on what exactly was presented at the open houses, but from talking with staff that participated in those events the presentations included red wolf program data, complaints received and general misconceptions about wolves, how we handle complaints and the use of depredation compensation funds for actual depredations, and the implementation of our Guidelines under the current rule until the rule could be clarified/revised, which was currently under development.

The last two documents are the first and most recent Adaptive Management Plans (AMP) that we use to implement recovery actions to abate hybridization in the wild population. In both of these documents we make reference to the importance of not removing wolves as it breaks up stable pairs and works contrary to recovering the red wolf. The AMP is revised every three years and is made available to the public. It, along with our Recovery/SSP Plan and Action Plan are what we use to manage the red wolf recovery program.

I also have the 2000 proposed rule first seeking change in the regulation that was submitted to the RO, but I did not want to clog your email with these documents. However, I want to relay a statement from the proposed rule package in which we state in the preproposal activities that:
"Red wolf program personnel met in June 1998 and identified hybridization as the number one issue facing the program. Service and Regional Solicitor's Office personnel met in January 1999 to consider the possible need for changes in the special rule. They concluded that sufficient flexibility existed in interpretation of the present rule to address the minor problems. In April 1999 a Population and Habitat Viability Assessment Workshop for the red wolf recognized hybridization as a serious threat and recommended strategies to address the problem. These activities resulted in the decision to propose rule changes to clearly express the management needs to recover the red wolf."

We have since revised the proposed rule and it is currently in the RO. Our current proposal is consistent with our original proposal in changes to removing wolves from private lands and the 1999 Guidelines. If you would like to see the 2000 proposed rule or the most recent version (2013), then please let me know.

Thank you,
David

On Mon, Dec 2, 2013 at 6:19 PM, Rabon, David <david_rabon@fws.gov> wrote:

Just skimming through the site, but from what I see I think this is great. We have a reference list on our website with similar documents, but its more like a bibliography. I like how this is presented. I will keep looking through it and see if we can make changes quickly with some of the more important documents.

Thank you,
David

On Mon, Dec 2, 2013 at 6:07 PM, Leopoldo Miranda <leopoldo_miranda@fws.gov> wrote:

Hit send too fast!

Here is the link:
http://www.fws.gov/chesapeakebay/endsppweb/beetle/ptbpublications.html

At the time we had many people questioning "our science" so we decided to do this site. We then publicized it to all communities including the landowners...

Leo
Leo Miranda
Assistant Regional Director - ES
US Fish and Wildlife Service
Southeast Region

Sent from Mobile

From: Leopoldo Miranda [mailto:leopoldo_miranda@fws.gov]
Sent: Monday, December 02, 2013 04:05 PM
To: 'david_rabon@fws.gov' <david_rabon@fws.gov>
Cc: 'jeffrey_m_fleming@fws.gov' <jeffrey_m_fleming@fws.gov>; 'david_viker@fws.gov' <david_viker@fws.gov>; 'elizabeth_souheaver@fws.gov' <elizabeth_souheaver@fws.gov>; 'Mike_Bryant@fws.gov' <Mike_Bryant@fws.gov>; 'stacy_shelton@fws.gov' <stacy_shelton@fws.gov>; 'jack_arnold@fws.gov' <jack_arnold@fws.gov>; 'aaron_valenta@fws.gov' <aaron_valenta@fws.gov>
Subject: Re: Two documents

Excellent! Yes, let's get as many as we could. Anything that is ours or in public domain, I think we should post on our website. If there are articles that could be found on the web from other sources, I would also recommend getting those links on our site too.

Here is one that we did in Chesapeake Bay: I think that the site we have now could look like this:

Leo Miranda

Assistant Regional Director - ES
US Fish and Wildlife Service
Southeast Region

Sent from Mobile

From: Rabon, David [mailto:david_rabon@fws.gov]
Sent: Monday, December 02, 2013 03:54 PM
To: Miranda, Leopoldo <leopoldo_miranda@fws.gov>
Cc: Jeffrey Fleming <jeffrey_m_fleming@fws.gov>; David Viker <David_Viker@fws.gov>; Elizabeth Souheaver <elizabeth_souheaver@fws.gov>; Mike Bryant <Mike_Bryant@fws.gov>; Stacy Shelton <Stacy_Shelton@fws.gov>; Jack Arnold <jack_arnold@fws.gov>; Aaron Valenta <aaron_valenta@fws.gov>
Subject: Re: Two documents

Hi Leo:

I am compiling a few other similar documents that will be useful to this conversation. They are mainly documenting the change in management and "policy" from the 1995 rule to how we have been operating since 1999. I hope to have them compiled by tomorrow to share, but I wanted to respond now to some of the questions that you asked.

I don't know the source of the interview that quotes Mike Phillips, but I suspect that it was published sometime between 1991 and 1995 before the rule change (1995) because these statements were indicative of our management of the wolves at that time.

With regard to the Kelly and Phillips article, that was a chapter in an edited book entitled "Endangered animals: a reference guide to conflicting issues." The complete citation is:

Kelly, B. T., and M. K. Phillips. 2000. Red wolf (Canis rufus). Pages 247-252 in R. Reading, and B. Miller, editors. Endangered animals: a reference guide to conflicting issues. Greenwood Press, Westport, CT, USA.

More to come...

Thank you,
David

On Fri, Nov 29, 2013 at 10:59 AM, Miranda, Leopoldo <leopoldo_miranda@fws.gov> wrote:

> Folks,
>
> You may have these already but I just wanted to make sure you all have them so we can use them for our discussions. One is a Press Release from 1995, three months before the publication of our 1995 rule. There we say that we will "protect private landowners against the unwanted presence of or depredations by red wolves." This is further explained in our in a letter/interview (Second page of the PDF but I don't have the whole document. Perhaps David, you may have it) from our red wolf project manager at the time Michael Phillips saying "Under that designation [NEP], private landowners can request that a wolf be removed from their property for any reason, and we are obligated to remover it". Anyway, these are the kind of public statements we have made in the past. We need to deal with them ASAP. The attached Technical Report predicted this conflict very well(check out second bullet point on page 10!). By the way, this is a good document and could be used to answer, in very simple language, many of the questions we

are being asked.

Finally, in this publication http://tesf.org/publications/kelly%20&%20phillips_%202000.pdf from Mr Kelly and Mr. Phillips explain, very well, the conflicts between our current rules and how it is affecting our recovery efforts. I don't know the source of this publication but looks like it is in a book or large document based on the page numbers. David, do you know?

Leo

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Twitter: www.twitter.com/redwolfrecovery

think you have received this email in error, please notify the sender.

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10 attachments

19981123_Memo_Kelly to RWRP staff.pdf
331K

19981201_Memo_Kelly to Henry.pdf
1943K

19990121_Discussion Paper - Red Wolf Regulations.pdf
1588K

19990128_Guidelines - Removing Wolves from Private Lands.pdf
384K

19990223_Briefing Paper_Jackson to Director.pdf
614K

19990315_Memo_Henry to Cole.pdf
1511K

19990724_Email_King to Kelly.pdf
146K

19991021_Letter_RWRP to Senator Basnight.pdf
404K

20000000_RWAMP_2000-2003.pdf
358K

20130211_RWAMP_2013-2015.pdf
314K

I am specifically asking you for written permission for me or my agents to remove/take any Red Wolves on my farm that your personnel have not removed. This is a request I have made for over 10 years.

Here is the law, plain and simple from the 1995 Rules Revisions:

"(v) Any private landowner may take red wolves found on his or her property in the areas defined in paragraphs (c)(9) (i) and (ii) of this section after efforts by project personnel to capture such animals have been abandoned, Provided that the Service project leader or biologist has approved such actions in writing"

Thanks again Leo. Your efforts to make corrections to this out of control program are appreciated.

[redacted]

--

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blog: trackthepack.blogspot.com
Twitter: www.twitter.com/redwolfrecovery

Leopoldo Miranda <leopoldo_miranda@fws.gov>

From:	Leopoldo Miranda <leopoldo_miranda@fws.gov>
Sent:	Tue Dec 17 2013 12:39:44 GMT-0700 (MST)

To: Rabon, David <david_rabon@fws.gov>
Subject: Re: Permission request to lawfully take Red Wolf

Thanks David! I think we have exhausted all options at Mr. [redacted] property. I fully understand the effects of these efforts in the population dynamics of the canids in that area. However, we need to comply by what is written in the rule and issue the letter to him.

Since the evidence shows that there may be a limited amount of wolves using the property (if any at all) I would suggest issuing the letter for one animal and for a period of time that could be easily identifiable (actual dates) but based on the science (eg, between now and before they starts giving birth in the spring?). What would be the best period?

I would like to get back to him by COB tomorrow and get him the letter by NLT Friday.

Darwin/Luis - if you are ok with this, is there any specific points that you would like to see in such a letter?

Leo

Sent from my iPad

On Dec 17, 2013, at 10:47 AM, "Rabon, David" <david_rabon@fws.gov> wrote:

> Hi Leo:
>
> We have several issues to address before issuing a permit or a letter of authorization. I am working through our options to try to find a more permanent solution. But, in short, here are the issues we face.
>
> ISSUE: We have not been able to evaluate exactly what animals are there since September 1, 2013.
>
> Mr. [redacted] originally had three wolves using portions of his property. We trapped two wolves off his property in early summer, but increasing temperatures prevented us from pursuing trapping of the third wolf. About that same time, the third wolf also started using adjacent lands (Mr. [redacted] property only encompassed a small proportion of the wolf's territory). When the temperatures decreased, we resumed assessing and trapping on his property, but he denied us access to his property beginning September 1, 2013. The third wolf recently turned up dead from gunshot (stuffed in a garbage bag and dumped on private property). Presumably, no more wolves were on his property but we did not have the ability to confirm this. We have wolf packs on adjacent lands that could move into the vacant territory of his property. In short, we have not abandoned attempts to remove the wolves from his lands – we were denied access.
>
> ISSUE: It appears that the animals using his property are not wolves, but we have not been able to confirm.
>
> Based on telemetry flights it looks like we have a sterile female coyote using portions of his property. In the most recent pictures that Mr. [redacted] provided, it looked like one of the animals was wearing a radio collar. If this is the case, then

that could be the sterile female coyote. Based on the size of the other animal in the pictures, it could be a male coyote running with the sterile female. That is very possible given the removal of the male wolf from that area. However, we have no way to determine that unless we assess the property. Essentially, we need to ground truth what we are seeing from aerial telemetry flights before we can provide any degree of certainty. Again, we have not abandon our efforts, but rather been delayed in taking further action to assess the situation.

ISSUE: No authorization for take is warranted if the animals are not wolves.

The law provides for Mr. [redacted] to remove the coyotes from his property if he so chooses. Our only request is that he return our collar (USFWS property) should he dispatch the female coyote. However, this would not be in his best interest. The two animals that are there (if indeed the two coyotes we suspect) are non-reproducing animals. They will likely hold that territory from other coyotes and won't be producing any more coyotes. It's also possible that another wolf pack will not move in, but there are no guarantees. Leaving the animals in place creates the best likelihood of stabilizing the area (that was true for the wolves too). Leaving the animals in place does not satisfy Mr. [redacted] desire to remove all predators from his property, but it will likely reduce the opportunity to more animals to move in.

UPDATE – In the course of righting this email, I learned this morning that the sterile female coyote is now being reported in mortality mode. She was detected this morning during our telemetry flight. She is on Mr. [redacted] farm. We are working to gain access to retrieve the carcass and collar. Obviously, this opens up the area for more canids to move in.

ISSUE: Constantly removing canids from his property means wolves could move into the vacant territory in the future.

Removing wolves, or now what we think are coyotes from his property, does not preclude other canids (especially wolves) from moving into the vacant area. If that happens, then we will have to continue to assess and trap these new animals off the property before we can justifiable "abandon" those efforts. And when we abandon those efforts, we can only provide a permit for removal that is limited in scope as per our rules and regulations. This puts us in a never ending cycle.

ISSUE: Currently, I am not aware of any existing "authorization" in which we can satisfy a request to permanently remove wolves from private lands.

I have contacted several other 10(j) recovery programs to determine if they have experienced similar requests or issues. Many have, but based on what they said, none have ever provided lethal take authorizations or permits. They have provided non-lethal take authorizations or permits. We have that option in this case under our existing rules and regulation and, in fact, have instructed landowners of that right. But I don't think that will satisfy Mr. [redacted] desire for a permanent solution, in part because there isn't a permanent solution… at least not an apparent one. Issuing him a letter of authorization only puts us into a continued cycle of assessing and trapping new animals coming onto his property once the old ones are removed. We are happy to work in that manner even with the increased workload, but it's not sustainable long-term. That is why we have

argued for a revision of the rules and regulations. And giving him a permanent letter of authorization for take is not consistent with our rules and regulations.

I am still waiting to hear back from a few folks to discuss options. And I am thinking about all possible ways to solve this issue. Any and all ideas are appreciated. I am happy to discuss ways to solve this that satisfies everyone's needs and desires.

Best,
David

On Mon, Dec 16, 2013 at 7:44 AM, Miranda, Leopoldo <leopoldo_miranda@fws.gov> wrote:

David/Pete/Mike

Here we go. Are there any remaining wolves in that area? I'm not sure this is a wolf or a coyote, the pictures are not that good. I know that three wolves were removed and the other was recently killed. Unless I hear otherwise I think this is a clear case where we have done everything we can to remove animals from his property. I don't see a reason where we can deny his request. Suggestions? We need to get back to him ASAP.

Leo

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---------- Forwarded message ----------
From: [redacted] <[redacted]aol.com>
Date: Mon, Dec 16, 2013 at 7:30 AM
Subject: Permission request to lawfully take Red Wolf
To: leopoldo_miranda@fws.gov
Cc: mitchstclair@suddenlink.net, dslaughi@aol.com, coley@bpropnc.com, tom.berry@berico.com, johnc@sboil.com, garry.spence@ncwildlife.org, Richard.edwards@ncwildlife.org, davidwhoylejr@gmail.com, ray.clifton@ncwildlife.org, wes@seegarsfence.com, joe@enceechemical.com, rwhite@mindspring.com, BSkinner3@aol.com, hayden.rogers@ncwildlife.org, druffin@triad.rr.com, jcogdell@forkstables.com, timothy.spear@ncwildlife.org, tfonville@fmrealty.com, Tom.berry@berico.com, john.clark@sampsonbladen.com, david.cobb@ncwildlife.org,

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john.drescher@newsobserver.com

Leo,

There is no doubt that you have pushed the Red Wolf issues in NC to the forefront as I have made my concerns known to you specfically. For this I am grateful. Your biologists have now trapped extensively on my farm at your direction, but the problem has become increasingly worse. Please see the attached 12 pictures from the night of December 15th. USFWS has ruined my farm!!!! As I have stressed to you, I would like USFWS to obey the law as opposed to me being placed in jeopardy of the law.

The caveat of you are not guilty of killing a wolf if you thought it was a coyote does not cut it with me. Especially with the current furor over the killing of Red Wolves. I, in no way should have to flirt with a violation of this magnitude, because of the USFWS's unwillingness to obey the law. That is just not right.

I am specifically asking you for written permission for me or my agents

to remove/take any Red Wolves on my farm that your personnel have not removed. This is a request I have made for over 10 years.

Here is the law, plain and simple from the 1995 Rules Revisions:

"(v) Any private landowner may take red wolves found on his or her property in the areas defined in paragraphs (c)(9) (i) and (ii) of this section after efforts by project personnel to capture such animals have been abandoned, Provided that the Service project leader or biologist has approved such actions in writing"

Thanks again Leo. Your efforts to make corrections to this out of control program are appreciated.

[redacted]

--

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"Valenta, Aaron" <aaron_valenta@fws.gov>

From: "Valenta, Aaron" <aaron_valenta@fws.gov>
Sent: Tue Dec 17 2013 12:52:54 GMT-0700 (MST)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1875 Century Boulevard
Atlanta, Georgia 30345

In Reply Refer To:
FWS/R4/ES

DEC 24 2013

Mr. John J. Ferebee, Jr.
701 Treybrooke Circle
Greenville, North Carolina 27834

Dear Mr. Ferebee:

Thank you for your email of December 16, 2013, in which you requested the U.S. Fish and Wildlife Service (Service) grant written permission to you and/or your agents to remove red wolves (*Canis rufus*) from your property, which consists of an approximately 2600-acre farm located in Tyrrell County, North Carolina and adjacent to the Pocosin Lakes National Wildlife Refuge (Refuge). Your email included photographs that you contend depict the presence of red wolves on your property. Although you assert in your email that red wolves are currently using your property, as of this date, the Service is not aware of any red wolves currently using your property.

The Service's Red Wolf Recovery Program (Program) staff worked with you during the spring and early summer of this year to remove three known red wolves that used a portion of your property as part of their home range. Two of the wolves were removed in late May 2013, and held in captivity for an extended period before being released pursuant to our regulations. One of these wolves established a new territory well away from your property, and the other was later found dead. As weather permitted, Program staff continued efforts on your property to trap the third wolf but was unable to do so. That wolf subsequently moved off of your property and began using the Refuge, which is part of the Red Wolf Recovery Area. Thereafter, you advised the Service that, beginning September 1, 2013, it could no longer access your property due to safety concerns during the deer hunting season. That wolf was found dead on private lands in Washington County in November 2013. Accordingly, we have abandoned trapping efforts for these animals.

After removing the two wolves from your property, Program staff noted that a sterile female coyote wearing a radio telemetry collar had moved into the area and begun using portions of your property. In the photographs that you provided with your December 16, 2013, email, we noted that at least one animal appears to be wearing a radio telemetry collar. We believe that the photographs likely depict the same sterile female coyote. We cannot positively identify all of the animals depicted, however, due to the poor quality of the photographs. As you are aware, the female coyote was found dead on your property earlier last week. Again, we appreciate your allowing the Service to access your property to retrieve the carcass and its radio telemetry collar.

As to your request for written permission to remove red wolves from your property, we do not believe that there is a need to provide such permission at this time. As stated in the preceding paragraph, the three wolves known to use your property are no longer doing so, and we have no data demonstrating the occurrence of other wolves on your property. Obviously, the Service cannot predict the future use of your property by the red wolves or coyotes, especially given the recent

removal of the coyote from your property. Because the coyote is not among the species regulated by the Service, any actions you choose to undertake to remove coyotes from your property must be implemented in accordance with the law of the State of North Carolina. A red wolf that is taken incidentally to any type of legal activity (e.g., hunting coyotes following state regulations) on private lands in the red wolf recovery area does not constitute a violation of the federal regulation, provided that the taking is not intentional or willful, and as long as the incident is reported to the Service or the North Carolina Wildlife Resources Commission within 24 hours.

The red wolf is a species over which the Service has regulatory authority. Consequently, if it were determined in the future that wolves had resumed use of your property, the circumstances and extent to which you and/or your agents could engage in activities to remove or "take" the species would be governed by the Service's regulation at 50 C.F.R. 17.84.

Although the Service believes that there are insufficient data demonstrating that red wolves are currently using your property, pursuant to 50 C.F.R. § 17.84(c)(10), the Service would welcome the opportunity to come onto your property to assess it for the occurrence of the species. Moreover, should the Service gather data through its telemetry flights or other daily activities indicating that wolves are again using portions of your property, we will notify you of such occurrences to ensure that you have the best information available. The Service also kindly requests that we be notified if a radio-collared animal is killed on your property and that you would allow its personnel to come onto your property to retrieve the radio telemetry collar on the animal for the purpose of data collection. Please contact David Rabon, the Service's Red Wolf Recovery Program Coordinator, at (252) 473-1132, extension 240, regarding the Service's accessing your property to perform any of the actions mentioned in this paragraph.

Again, the Service welcomes the opportunity to work with and assist you in addressing matters pertaining to Red Wolves. Pursuant to your correspondence of March 22, 2013, we are providing copies of this letter to James R. Prewitt and Daniel H. Woody, whom you identified as co-owners of the property. If you have any questions, please feel free to contact me at (404) 679-7085.

Sincerely yours,

Leopoldo Miranda
Assistant Regional Director
Ecological Services

cc:
David Rabon, Red Wolf Recovery Program Coordinator
Gordon Myers, Director, North Carolina Wildlife Resources Commission
James Prewitt (co-owner)
Daniel Woody (co-owner)

BISON CONNECT

Mr. [redacted] Letter update

2 messages

Rabon, David <david_rabon@fws.gov> Fri, Dec 20, 2013 at 1:44 PM
To: Mike Bryant <Mike_Bryant@fws.gov>
Cc: Pete Benjamin <Pete_Benjamin@fws.gov>

Hi Mike:

Just wanted to update you on the Mr. [redacted] letter issue.

Jack Arnold (DARD-ES) and Aaron Valenta (Chief, Restoration and Recovery) called me this morning to ask for a revision of the letter for Mr. [redacted]. They said that the solicitor did not think the authorization for take was justified based on the information in our administrative record and the fact that we had not abandon our efforts to remove wolves from Mr. [redacted]'s property. They asked me to clean up the administrative record by providing a memo to the file that updates the status of wolves at Mr. [redacted]'s and to write a letter tell Mr. [redacted] that he would not be in violation of our regulations if he took a red wolf while engaged in a lawful activity and the take wasn't willful or with intent.

A draft version of the letter I prepared is attached. I provided it to Jack this afternoon. He was seeking review with OLE before making a decision to send. I also told Jack that I thought the letter had the effect of 'cleaning up' the administrative record to show that the known wolves once using Mr. [redacted]'s property are no longer there, but that it did not preclude the future use of the property by other wolves. I also am preparing an Information Memorandum on the topic. That too should help clarify the history of the issue.

Have a great holiday!

David

--

David R. Rabon, Jr., PhD
Coordinator, Red Wolf Recovery Program
U.S. Fish and Wildlife Service
Post Office Box 1969
Manteo, North Carolina 27954

telephone: 252.473.1132 x 240
telefax: 252.473.4836
email: david_rabon@fws.gov

website: www.fws.gov/redwolf
Facebook: www.facebook.com/redwolfrecoveryprogram
blog: trackthepack.blogspot.com
Twitter: www.twitter.com/redwolfrecovery

20131220_Letter-draft[redacted]_Response to 20131216 email.docx
44K

Bryant, Mike <mike_bryant@fws.gov> Tue, Dec 24, 2013 at 12:25 PM
To: "Rabon, David" <david_rabon@fws.gov>
Cc: Pete Benjamin <Pete_Benjamin@fws.gov>

Thank you for persevering on this precedent setting issue.
[Quoted text hidden]
--
Michael R. Bryant
Project Leader
Coastal North Carolina
National Wildlife Refuges Complex
P.O. Box 1969
100 Conservation Way
Manteo, NC 27954
mike_bryant@fws.gov
252-473-1131 ext 222
fax 252-473-1668
cell 252-216-7505

United States Department of Interior

FISH AND WILDLIFE SERVICE
1875 Century Boulevard
Atlanta, Georgia 30345

February 6, 2014

In Reply Refer To:
FWS/R4

[redacted]

Based on the recent data we have reconsidered our decision to authorize the take of red wolves on your property at this time. On February 4, 2014, you requested that the U.S. Fish and Wildlife Service (Service) reconsider our position, as provided in a letter dated December 24, 2013, denying you and/or your agents the permission to remove red wolves from your property. That decision was based on insufficient data demonstrating that red wolves were using your property. At that time we also requested that if you engaged in coyote control activities, following the State of North Carolina's regulations, and a wolf was incidentally trapped or killed that you notify us within 24 hours as dictated by the Service's regulation at 50 C.F.R. 17.84. Since then, you have contacted us on four different occasions to notify us that that a canid was trapped on your property. I would like to express my gratitude for your prompt communication of these incidents. Because of your timely communications, our field biologists were able to come to your property and identify the animals, two of which were in fact red wolves and were taken to our captive management facility.

On February 4, you notified us of another canid trapped on your property. After evaluating the animal, we determined it was a coyote and, as with the other trapped coyotes, it was left on site for your disposal following State regulations. At that time, you also informed us that additional collared canids had been documented on your field cameras on at least three occasions. We have not yet been able to confirm the identity, the total number of collared canids present on your camera pictures, or the extent with which they are using your property. However, your recent trapping efforts clearly demonstrated that red wolves have been present on your property after our December 24, 2013 letter.

Your property is adjacent to a National Wildlife Refuge on which red wolves occur. As such, there is no doubt that red wolves have used your property and will likely occur on your property in the future. As you are aware, Section 9 of the Endangered Species Act and federal regulation pursuant to section 4(d) of the Act prohibit take of endangered and threatened species, respectively, without special exemption such as the protections afforded to you as the landowner for a wide variety of actions you may take to protect your interests, including actions that result in "take" of red wolves. Specifically, you may absolutely take by lethal means wolves that are threatening you, others, livestock or pets on your property or you may take wolves incidental to

otherwise lawful activities, such as coyote trapping, so long as those activities have been conducted in accordance with other local, State and Federal regulations. And finally you may take specific wolves on your property intentionally after we have abandoned efforts to capture the animal(s) and such take is approved in writing. All take must be reported within twenty-four hours. I spell the above out because we believe it describes well the way you have been managing the situation and the cooperative manner in which you have been working with us over the past several months. You have been doing this and we thank you for your prompt notifications to us in this regard.

The last exception above states that in order to apply, we must have abandoned efforts to capture the animal in question. Regarding the canids you have documented using your property since we removed wolves from your property on January 23, though we cannot confirm that the animal is a wolf and we have not attempted to capture it, we can state at this time given our other staffing commitments and lack of access to actively trap on the property that we are foreclosed from pursuing the animal on your property and in that sense must abandon efforts to capture and relocate the animal ourselves. Therefore, pursuant to the Service's regulation at 50 C.F.R. 17.84, you and your agents (e.g., co-owners of the property [redacted]) are granted permission to take this animal (should it be a red wolf) by lethal means as long as the taking is in compliance with any other applicable Federal, State, and local regulations.

This authorization is valid for 180 days from the date of this letter. If any collared animal is killed on your property, under the terms of this letter, you must notify the Service or the North Carolina Wildlife Resource Commission (NCWRC) within 24 hours of the incident. This will allow personnel from our recovery program or the NCWRC to evaluate it is a red wolf or a management coyote (i.e., sterile collared coyote) and retrieve the radio telemetry collar on the animal for the purpose of data collection. If the animal is a management coyote, the killing of it will not be considered a take of a red wolf under the terms of this authorization.

We encourage you to continue to pursue non-lethal means for taking this animal and use lethal means only as a last resort. We understand that the regular trapping season in North Carolina ends on February 28, 2014 and the options for non-lethal take will be limited. We are particularly concerned about the potential for lethal take of red wolves at this time of year as we are entering the whelping season and the loss of breeding females or females with pups would have a particularly disruptive effect on the population. Therefore, we suggest that you explore the option of requesting a depredation permit from the NCWRC as a possible avenue to continue to pursue non-lethal means for taking this animal. If non-lethal means are used (i.e., trapping) the Service will be willing to reimburse you for the costs of trapping a red wolf as long as the activities are performed following Federal, State and local regulations.

Obviously, the Service cannot predict the future use of your property by other red wolves. However, we remain committed to working diligently with you in responding to your needs. To that end, we would welcome opportunities to better inform our collective management efforts. Should the Service or the NCWRC gather data through their telemetry flights or other daily activities indicating that wolves are using portions of your property, we will notify you of such occurrences, within 24 hours, to ensure that you have the best information available. At that time, we will request your permission to come onto the property to attempt to capture and relocate the animals. We also ask that you consider sharing your trapping information with the

Service and the NCWRC as it would be very useful to us in our continued efforts to manage the population of red wolves and coyotes and in assisting you with to fulfill your management goals. Lastly, we would welcome an opportunity to discuss ways that we could better assist you in your trapping efforts as we appreciate the financial burden.

I believe that you have demonstrated that private landowners, the State, and the Service can work together in solving many of the canid management challenges in eastern North Carolina. Again, the Service welcomes the opportunity to work with and assist you in addressing matters pertaining to red wolves. If you have any questions, please feel free to contact Mr. Pete Benjamin at our Raleigh Field Office at (919) 856-4520, Dr. David Rabon, Red Wolf Recovery Program Coordinator at (252) 473-1132, or me at (404) 679-7085.

Sincerely yours,

Leopoldo Miranda
Assistant Regional Director
Ecological Services

cc:

Gordon Myers, Director, North Carolina Wildlife Resources Commission

Morgan, Don <don_morgan@fws.gov>

Fwd: New Feb 19 News Article

1 message

Frazer, Gary <gary_frazer@fws.gov> Thu, Feb 20, 2014 at 7:31 PM
To: Paul Souza <Paul_Souza@fws.gov>, Jeff Newman <jeff_newman@fws.gov>, Don Morgan <Don_Morgan@fws.gov>

Leo told me today that the Region may re-think moving forward at this time with their 10(j) rule revision. They may opt to do something more fundamental. Sounds like they are reconsidering whether this expop has any likelihood of success. -- GDF

Gary Frazer
Assistant Director -- Ecological Services
U.S. Fish and Wildlife Service
(202) 208-4646

---------- Forwarded message ----------
From: **Leopoldo Miranda** <leopoldo_miranda@fws.gov>
Date: Thu, Feb 20, 2014 at 10:42 AM
Subject: Fwd: New Feb 19 News Article
To: Gary Frazer <gary_frazer@fws.gov>

Do you have a few minutes later today?

Leo

USFWS Assistant Regional Director
Ecological Services, Southeast Region
404-679-7085 (office)
404-353-6448 (mobile)
Leopoldo_Miranda@fws.gov

Sent from my iPhone

Begin forwarded message:

> **From:** Jett Ferebee <jettferebee@aol.com>
> **Date:** February 20, 2014 at 8:26:43 AM MST
> **To:** <mitchstclair@suddenlink.net>, <dslaughi@aol.com>, <coley@bpropnc.com>, <tom.berry@berico.com>, <johnc@sboil.com>, <garry.spence@ncwildlife.org>, <Richard.edwards@ncwildlife.org>, <davidwhoylejr@gmail.com>, <ray.clifton@ncwildlife.org>, <wes@seegarsfence.com>, <joe@enceechemical.com>, <rwhite@mindspring.com>, <BSkinner3@aol.com>, <hayden.rogers@ncwildlife.org>, <druffin@triad.rr.com>, <jcogdell@forkstables.com>, <brian@atmusa.com>, <timothy.spear@ncwildlife.org>, <tfonville@fmrealty.com>, <Tom.berry@berico.com>, <john.clark@sampsonbladen.com>, <david.cobb@ncwildlife.org>, <mallory.martin@ncwildlife.org>, <gordon.myers@ncwildlife.org>, <mbulleri@ncdoj.gov>, <plm1@nc.gov>, <bill.daughtridge@doa.nc.gov>, <leopoldo_miranda@fws.gov>, <cynthia_dohner@fws.gov>, <dan_ashe@fws.gov>
> **Subject: New Feb 19 News Article**

http://compassnews360.com/node/2014/02/20/landowner-gets-first-ever-permit-to-kill-a-red-wolf/

This is good, but I do not want to use the permit. The goal is for USFWS to trap any remaining nonhybridized wolves and relocate them to a place where they are safe from interbreeding with coyotes. This was the critical success factor for the program, which no longer exists. USFWS trapped and relocated these wolves to save them from hybridization three previous times - in Texas, Tennessee and western NC. It is time our representatives insist this action be taken once again to protect this animal from extinction in the wild as happened in Texas. If Judge Boyle bans coyote hunting on the Albemarle peninsula, we will have two top predators fully protected while they multiply, hybridize, and destroy the wildlife resources of our state. Amazing...

Jett Ferebee

BISON CONNECT

Harrison, Rebecca <rebecca_harrison@fws.gov>

Re: red wolf removal request

Beyer, Arthur <arthur_beyer@fws.gov> Tue, Jul 8, 2014 at 9:01 AM
To: "Miranda, Leopoldo" <leopoldo_miranda@fws.gov>
Cc: David Rabon <david_rabon@fws.gov>, Pete Benjamin <pete_benjamin@fws.gov>, Michelle Eversen <michelle_eversen@fws.gov>, Rebecca Harrison <rebecca_bartel@fws.gov>

Ok. Other than [redacted] I will wait to respond till we know how we are going to proceed.

I'm sure you all are aware of this as well, but this will be very difficult logistically. Also, on some of these properties we do not have wolves present so it may not become an issue, but some, as in [redacted] case, we have intact wolf packs with pups born late April that only use part of the requestor's property, and where we have permission or support on lands surrounding them.

On Tue, Jul 8, 2014 at 8:18 AM, Miranda, Leopoldo <leopoldo_miranda@fws.gov> wrote:

Here is another one. I think we will get more and more. Later this week let's try to circle back and have a discussion about how to proceed. I have asked Gordon about the status of the state permit. I'll let you all know once I get a response.

In terms of the worker's comp and insurance issue, we can dig that out from here. I think we are in good shape there, just need to find the language.

Leo

Leopoldo "Leo" Miranda
U.S. Fish and Wildlife Service
Assistant Regional Director, Ecological Services
Southeast U.S., Puerto Rico and U.S. Virgin Islands
1875 Century Boulevard
Atlanta, GA 30345
1-404-679-7085 (phone)
1-404-353-6448 (Blackberry)
1-404-679-7081 (fax)
Leopoldo_Miranda@fws.gov

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

---------- Forwarded message ----------
From: [redacted]
Date: Tue, Jul 8, 2014 at 7:15 AM
Subject: red wolf removal request
To: Leopoldo Miranda <leopoldo_miranda@fws.gov>
Cc: [redacted] [redacted]>, "Gordon S. Myers" <gordon.myers@ncwildlife.org>

Mr. Miranda,

Please find attached my letter requesting that red wolves be removed from all of my properties in Washington and Hyde County. Thank you for your attention to this matter.

Respectfully,

[redacted]

[redacted]

For Immediate Release August 29, 2014
Media contact: Tom MacKenzie, 404-679-7291, tom_mackenzie@fws.gov
Media Availability: 1:00 p.m., Friday, August 29, 2014, 877-917-5786- Passcode: red wolf

Eastern North Carolina Red Wolf Population Under Review

--Focus Group Sessions Scheduled –

The U.S. Fish and Wildlife Service awarded a contract to conduct a review of the Eastern North Carolina non-essential, experimental red wolf population to the Wildlife Management Institute (WMI), of Cabot, Virginia. Founded in 1911, WMI is a private, non-profit, scientific and educational organization, dedicated to the conservation, enhancement, and professional management of North America's wildlife and other natural resources.

The evaluation will be completed in 60 days by October 10, 2014. Under the Service's contract, it will be peer reviewed and then used to help the Service determine the program's future. That determination is expected to be finalized in early 2015. The evaluation will cover three primary areas: scientific, management, and public attitudes.

"Program evaluations are a normal practice to ensure optimal effectiveness and have been conducted in other recovery programs, such as the Mexican wolf recovery program," said Leopoldo Miranda, Assistant Regional Director of Ecological Services in the Service's Southeast Region. "Once we receive the final evaluation, we will review it and make a decision to continue, modify, or terminate the red wolf recovery program non-essential, experimental population in North Carolina."

"The North Carolina Wildlife Resources Commission fully supports this evaluation to ensure the red wolf recovery program is based on sound-science and is managed in full alignment with the Red Wolf Recovery Plan," said Gordon Myers, Executive Director, North Carolina Wildlife Resources Commission. "We are committed to assisting the Service any way we can throughout this process."

"We are interested in the public's perspectives regarding red wolves, and red wolf recovery efforts in Eastern North Carolina," Miranda added. "As part of the human dimensions portion of the evaluation, the Service also asked WMI to conduct two public focus group sessions."

WMI will host the first in Swan Quarter, North Carolina, from 7:00 p.m. to 9:00 p.m. on Wednesday, September 10, in the Mattamuskeet High School Cafeteria located at 20392 U.S. Highway 264. The second will be held in Columbia, North Carolina, from 7:00 p.m. to 9:00 p.m. on Thursday, September 11, in the Columbia High School's Auditorium at 902 East Main Street

Interested individuals may submit comments, concerns, or information regarding the Eastern North Carolina non-essential, experimental red wolf population and the program evaluation to

the following e-mail: redwolfreview@fws.gov. WMI also is conducting a brief voluntary online survey that does not request any personal identifiable information. Interested individuals may submit input to either, or both. To access the survey visit the following link: http://jgassett.polldaddy.com/s/red-wolf-restoration-recovery-program.

Any comments should be submitted no later than September 12, 2014. This will allow WMI time to review the comments and ensure relevant information can be considered during the review. Comments received after that date will not be considered in the program evaluation.

The U.S. Fish and Wildlife Service is the principal federal agency responsible for conserving, protecting and enhancing fish, wildlife and plants and their habitats for the continuing benefit of the American people. For more information on our work and the people who make it happen, visit www.fws.gov/southeast. Connect with us on Facebook at www.facebook.com/usfwssoutheast, follow our tweets at www.twitter.com/usfwssoutheast, watch our YouTube Channel at http://www.youtube.com/usfws, and download photos from our Flickr page at http://www.flickr.com/photos/usfwssoutheast.

###

SOUTHERN ENVIRONMENTAL LAW CENTER

Telephone 919-967-1450 | 601 WEST ROSEMARY STREET, SUITE 220
CHAPEL HILL, NC 27516-2356 | Facsimile 919-929-9421

September 2, 2014

Cynthia Dohner
Regional Director
Southeast Region
U.S. Fish and Wildlife Service
1875 Century Boulevard Northeast, Suite 400
Atlanta, GA 30345

Sent via electronic mail to: redwolfreview@fws.gov

Dear Ms. Dohner:

On behalf of the Red Wolf Coalition, Defenders of Wildlife, and Animal Welfare Institute, the Southern Environmental Law Center is writing to express our grave concerns about the process announced for the Red Wolf Program Review via press release on August 29, 2014. Through that release, the public received its first notice of the program review that the Fish and Wildlife Service ("FWS") and the Wildlife Management Institute are currently undertaking. This informal notice and minimal opportunity for public involvement does not comply with the law and does not take seriously the FWS's responsibilities for preventing the extinction of the red wolf in the wild.

First, we note that this press release was issued the Friday before a holiday weekend, at a time when it is likely to get very little attention. In addition, the notice was issued via press release and not in the Federal Register as an official public notice with a formal public review process. Both of these factors will curtail public knowledge of the review, as well as opportunity for involvement.

Second, the time and opportunities provided for public involvement are entirely insufficient. While the notice states that this is a 60-day review, the public notice is being provided almost halfway through this timeframe. Moreover, the public is being given less than two weeks to provide their input either in writing or in person. When combined with the poor quality of the notice provided, interested individuals may be excluded from this process altogether.

Third, the announcement states that there will be "focus groups" held September 10th and 11th in Swan Quarter and Columbia, North Carolina, two rural communities located multiple hours drive from significant population centers. While we appreciate the interests of residents who live in the heart of the Red Wolf Recovery Area, they are not the only citizens interested in the future of the 100 red wolves remaining in the wild. As an endangered species, red wolves are managed in trust for the people of the United States by the FWS. It is inappropriate to exclude from the in-person meetings not only the vast majority of North Carolinians who care about red wolves, but also red wolf supporters throughout the United States.

Finally, we note our concerns about both the "survey" linked to in the FWS release, and about the "focus group" format for the in-person meetings. Regarding the survey, Question 8, in which participants are asked to rank the "threats of Red Wolf Restoration," is of particular concern. There is no opportunity to say that the participant is not concerned about one or more of these factors, or to rate the participant's overall concern regarding the program, seemingly biasing the results in favor of program termination. The "focus group" format announced for the in-person meetings similarly raises concerns that individuals will not be given the opportunity to freely express their support for the Red Wolf Recovery Program.

While the Endangered Species Act provides for the periodic review of the status of species, 16 U.S.C. § 1533(c)(2), the current review does not appear designed to follow that mandate either in terms of process or substance. The Act requires that listed species be evaluated every five years to determine whether they should be removed from the endangered or threatened species list or whether their status should be changed. Any such evaluation and review must be published in the Federal Register pursuant to 50 C.F.R. § 424.21. Such evaluations, moreover, are to be made on the basis of the Act's listing factors and criteria contained at 16 U.S.C. § 1533(a) and (b), which includes the requirement that any such determinations "shall" be made "solely on the basis of the best scientific and commercial data available." Id. at (b). The last such review for red wolves occurred in 2007 and carefully assessed the science surrounding the threats to the species and the management measures necessary to provide for the conservation of the species. The notice of the 2007 evaluation was originally published in the Federal Register on September 20, 2005, 70 Fed. Reg. 55157, and provided the public 60 days to submit comments.

While we intend to provide further substantive comments in the coming weeks, we call on the FWS to immediately and fully comply with the Endangered Species Act and the National Environmental Policy Act and conduct a scientifically based and open process to review the Red Wolf Recovery Program. This must include, at a minimum, adequate environmental review, a 60-day comment period, and public hearings in accessible population centers, including Raleigh-Durham, North Carolina.

Sincerely,

Sierra B. Weaver

cc:
Dan Ashe, Director, FWS
Gary Frazer, Assistant Director for Endangered Species, FWS
Leopoldo Miranda, Assistant Regional Director for Ecological Services, Southeast Region, FWS
Steven Williams, President, Wildlife Management Institute
Jonathan Gassett, Southeast Regional Field Representative, Wildlife Management Institute

Harrison, Rebecca <rebecca_harrison@fws.gov>

Update on responses to removal request letters

Benjamin, Pete <pete_benjamin@fws.gov> Tue, Sep 2, 2014 at 1:12 PM
To: Leopoldo Miranda <leopoldo_miranda@fws.gov>, Michelle Eversen <michelle_eversen@fws.gov>, Arthur Beyer <arthur_beyer@fws.gov>, Rebecca Harrison <rebecca_bartel@fws.gov>, Tom MacKenzie <tom_mackenzie@fws.gov>

Over the past several weeks we have received a large number of letters from people requesting that wolves be removed from their property. Most of these letters are identical in terms of format and wording.

The red wolf staff have been reaching out to the requestors. Here is a brief run down of the results of that coordination to date.

Of a total of 228 letters received to date:

We have received no response from attempts to contact 167 requestors. We have sent notices to 72 of these folks indicating that if we do not hear from them in two weeks we will consider the matter closed. Our intent is to send such notices to all such requestors just to make sure we are closing the loop.

We contacted an additional 26 people who indicated either that they did not know they were signing a request to have wolves removed from their property, that wolves do not use their property, or that they do not have a problem with wolves using their property. Many thought they were signing a petition related to coyote hunting.

There were 19 letters with no contact information. These are considered closed.

There are 12 requestors that we are currently working with to assess the extent of wolf use of their property and to coordinate next steps. Four of these have received letters advising them of the status of our review of their request and how to proceed with trapping efforts should they chose to use a private trapper.

We are in the process of contacting 4 other requestors.

To summarize, 93 percent of the 228 requests received to date have been dead ends (no response, no contact information or, requestors do not have a problem with wolves on their property). This may change if we eventually hear from some of the 167 landowners we have attempted to contact without success.

As a side note, last week I noticed that the marque in front of the gun shop on US 64 in Mackey's Ferry said "...sign your red wolf removal letter today."

Thanks to Art, Matt and all the guys for their continued hard work on this.

Pete Benjamin
Field Supervisor
Raleigh ES Field Office
Office: (919) 856-4520 x 11
Mobile: (919) 816-6408

Benjamin, Pete <pete_benjamin@fws.gov>

updated complaint numbers

6 messages

Beyer, Arthur <arthur_beyer@fws.gov> Thu, Oct 30, 2014 at 10:20 AM
To: Pete Benjamin <pete_benjamin@fws.gov>

Hey Pete,

Here are update numbers on the removal requests. Some of the closed now include requestors such as [redacted], where we have from our standpoint completed what we can do and have informed the landowner, but of course knowing any of these could be reopened at any time.

405 Individual requests

- 24 Duplicate request from same address
- 9 working
- 43 no contact info
- 282 No response
- 71 Closed
- 14 - petition only
- 25 - Landowner reported no wolves - will call
- 21 - No wolves - survey completed
- 4 - Combine with working request
- 2 - No access
- 5 - No response

Benjamin, Pete <pete_benjamin@fws.gov> Thu, Oct 30, 2014 at 11:27 AM
To: "Beyer, Arthur" <arthur_beyer@fws.gov>

Thanks much. What is the difference between the 282 no responses and the 5 Closed - no responses?

Pete Benjamin
Field Supervisor
Raleigh ES Field Office
Office: (919) 856-4520 x 11
Mobile: (919) 816-6408

[Quoted text hidden]

Beyer, Arthur <arthur_beyer@fws.gov> Thu, Oct 30, 2014 at 11:40 AM
To: "Benjamin, Pete" <pete_benjamin@fws.gov>

Good question - the 282 refer to those we never received any response from our initial inquiry following their letter. The others refer to those we received an initial respone from and had contact with to some degree, but then did not receive any further response. For example, Chris had met with a landowner who, after Chris's conversation wanted to think about it more and get back with us. Even if we tried to contact them further, we still have received no response. Now of course, if they call today that would simply be reopened, or at least considered based on the conversation.

Hope that makes sense - it did in my head but that can be a scary place.

[Quoted text hidden]

Benjamin, Pete <pete_benjamin@fws.gov> Thu, Oct 30, 2014 at 12:10 PM
To: "Beyer, Arthur" <arthur_beyer@fws.gov>

Makes sense. Thanks,

Pete Benjamin
Field Supervisor
Raleigh ES Field Office
Office: (919) 856-4520 x 11
Mobile: (919) 816-6408

[Quoted text hidden]

Benjamin, Pete <pete_benjamin@fws.gov> Wed, Apr 27, 2016 at 8:34 AM
To: Christopher Serenari <christopher.serenari@ncwildlife.org>

Hi Christopher,

As I mentioned last week here are the summary statistics related to the barrage of requests to remove wolves from private lands that we began receiving in July 2014. By the time of Art's email (10/30/14) those requests had stopped coming. These numbers are updated and therefore slightly different from the numbers provided on page 53 of the WMI review. Let me know if you want more info.

Pete Benjamin
Field Supervisor
Raleigh ES Field Office
Office: (919) 856-4520 x 11
Mobile: (919) 816-6408

[Quoted text hidden]

Serenari, Christopher <christopher.serenari@ncwildlife.org> Wed, Apr 27, 2016 at 9:32 AM
To: "Benjamin, Pete" <pete_benjamin@fws.gov>

Good stuff, Pete. Thank you.

CS

Christopher Serenari, Ph.D.

Human Dimensions Biologist

NC Wildlife Resources Commission

1751 Varsity Drive

Raleigh, NC 27606

Office: 919.707.0057

Cell: 919.618.1924

http://www.ncwildlife.org

Email correspondence to and from this sender is subject to the N.C. Public Records Law and may be disclosed to third parties.

From: Benjamin, Pete [mailto:pete_benjamin@fws.gov]
Sent: Wednesday, April 27, 2016 8:35 AM
To: Serenari, Christopher <christopher.serenari@ncwildlife.org>
Subject: Fwd: updated complaint numbers

[Quoted text hidden]

Harrison, Rebecca <rebecca_harrison@fws.gov>

removal request

Miranda, Leopoldo <leopoldo_miranda@fws.gov> Wed, Jul 9, 2014 at 11:38 AM
To: "Beyer, Arthur" <arthur_beyer@fws.gov>
Cc: Rebecca Harrison <rebecca_harrison@fws.gov>, David Rabon <david_rabon@fws.gov>, Pete Benjamin <pete_benjamin@fws.gov>, Michelle Eversen <michelle_eversen@fws.gov>, Jack Arnold <jack_arnold@fws.gov>

Thank you Art! This is good information. Probably we can "close the loop" with this particular landowner in terms of agreeing to inform him is wolves incorporate his lands within a territory.

On the other issue. I'm glad to see Mr. [redacted] supporting the program! As for the efforts to recruit other landowners I think we will get more of these requests. We just want to be as responsive as possible and respond within 48 hrs as stated in the rule. We will need to regroup and define a strategy on how to manage whatever we need to do for each of the requests. It is a huge workload issue.

Leopoldo "Leo" Miranda
U.S. Fish and Wildlife Service
Assistant Regional Director, Ecological Services
Southeast U.S., Puerto Rico and U.S. Virgin Islands
1875 Century Boulevard
Atlanta, GA 30345
1-404-679-7085 (phone)
1-404-353-6448 (Blackberry)
1-404-679-7081 (fax)
Leopoldo_Miranda@fws.gov

On Wed, Jul 9, 2014 at 10:21 AM, Beyer, Arthur <arthur_beyer@fws.gov> wrote:

> Hey Leo,
>
> Just wanted to forward Mr. [redacted] response. Apparently he was pursuing removal of wolves and a take permit without currently having wolves on the property. The property of his we found included two tracts, each only 70 acres in size.
>
> I also wanted to forward a conversation I had with a [redacted] in Hyde County. He manages over [redacted] acres in Hyde and Tyrrell Counties and called me this morning to ask that I speak to the owners of [redacted] next week. What prompted his request was his receiving a call from Mr. [redacted] this morning. Apparently Mr. [redacted] is calling landowners/managers in the recovery area to join against the wolf program, which explains the sudden increase in removal and permit requests and the form letter they are all using.
>
> Mr [redacted] however is very supportive of us, and responded to Mr. [redacted] s request by stating his support and working relationship with our program. He also responded to Mr [redacted] that they have very good deer numbers along with other game species even though having large numbers of wolves on the property. [redacted] and a property in Tyrrell County have provided habitat for two of the largest ongoing

packs of wolves on private land since the inception of the program.

---------- Forwarded message ----------
From: [redacted] [redacted]
Date: Wed, Jul 9, 2014 at 7:27 AM
Subject: Re: removal request
To: arthur_beyer@fws.gov

Mr Beyer, Thanks for the follow up. Currently there are NO wolves on my property in SW Hyde Co., but I, and all the other land owners in that area, do not want them and would want them removed when they inevitably get there. Some friends of mine are "ground zero" of the private property/red wolf conflict. The wolves, and the coyotes that they are breeding with, have nearly ruined the farm for recreational purposes. It is a disatrous result. We are trying to be proactive,but will call immediately if any are seen in the area.
[redacted]

-----Original Message-----
From: Beyer, Arthur <arthur_beyer@fws.gov>
To: [redacted] [redacted]
Cc: Leopoldo Miranda <leopoldo_miranda@fws.gov>
Sent: Tue, Jul 8, 2014 3:57 pm
Subject: removal request

Mr. [redacted]

I received your request for the removal of red wolves from your property. In order to conduct a ground survey of your property, please provide written permission for access and any relevant information we would need such as exactly where and how to access the property. We will attempt to conduct surveys as soon as possible pending weather and personnel availability. I will follow up with you afterward regarding our findings.

Thank you.

Art Beyer
Red Wolf Recovery Program
(252) 475-8355

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh ES Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

September 23, 2014

Mr. John J. Ferebee, Jr.
701 Treybrooke Circle
Greenville, North Carolina 27834

Dear Mr. Ferebee:

We have reviewed your August 29, 2014, letter requesting renewal of the authorization previously provide to you by the U.S. Fish and Wildlife Service (Service) to take a red wolf that is currently using your property in Tyrell County, North Carolina. Your letter provided evidence of current wolf activity which correlates with radio telemetry data collected by our Red Wolf Recovery Team. It does appear that the radio-collared adult male red wolf that you were previously authorized to take is still using your property. Additionally, a collared sterile coyote was recently known to be utilizing an area north of your property and may be present on your land.

The Service provided the original authorization to you in a letter dated February 6, 2014. This authorization was provided in accordance with our regulations at 50 C.F.R. 17.84, which state that private landowners may take red wolves found on their property within the Red Wolf Recovery Area after efforts by Service personnel to capture such animals have been abandoned, provided that the Service has approved such actions in writing and all such taking shall be reported to the Service within 24 hours.

Prior to issuance of our original authorization you had demonstrated that wolves were consistently using your property despite continued efforts by Service personnel and private trappers hired by you to remove said animals. Your property is adjacent to a National Wildlife Refuge on which red wolves occur. As such, there is no doubt that red wolves have used your property and will likely occur on your property in the future. As you are aware, Section 9 of the Endangered Species Act and federal regulation pursuant to section 4(d) of the Act prohibit take of endangered and threatened species, respectively, without special exemption such as the protections afforded to you as the landowner for a wide variety of actions you may take to protect your interests, including actions that result in "take" of red wolves. Specifically, you may absolutely take by lethal means wolves that are threatening you, others, livestock or pets on your property or you may take wolves incidental to otherwise lawful activities, such as coyote trapping, so long as those activities have been conducted in accordance with other local, State and Federal regulations. I spell the above out because we believe it describes well the way you have been managing the situation and the cooperative manner in which you have been working with us over the past several months.

Our regulations state that before the Service can provide authorization to a landowner to take red wolves for reasons other than depredation or threats to people and property we must have abandoned our efforts to capture the animal. Over the years many attempts have been made to remove wolves from your property, and while these efforts have often been successful wolves have continued to occupy your land. At this time given our other staffing commitments and lack of access to actively trap on the property we conclude that we are foreclosed from pursuing the animal on your property and in that sense must abandon efforts to capture and relocate the animal ourselves. Therefore, pursuant to the Service's regulation at 50 C.F.R. 17.84, you and your agents (e.g., co-owners of the property James R. Prewitt and Daniel H. Woody) are granted permission to take this animal (should it be a red wolf) by lethal means as long as the taking is in compliance with any other applicable Federal, State, and local regulations.

This authorization is valid for 180 days from the date of this letter. If any wolf is killed on your property, under the terms of this letter, you must notify the Service or the North Carolina Wildlife Resource Commission (NCWRC) within 24 hours of the incident. We encourage you to continue to pursue non-lethal means for taking this animal and use lethal means only as a last resort. If non-lethal means are used (i.e., trapping) the Service will be willing to reimburse you for the costs of trapping that red wolf as long as the activities are performed following Federal, State and local regulations.

Obviously, the Service cannot predict the future use of your property by other red wolves. However, we remain committed to working diligently with you in responding to your needs. To that end, we would welcome opportunities to better inform our collective management efforts. Should the Service or the NCWRC gather data through their telemetry flights or other daily activities indicating that wolves are using portions of your property, we will notify you of such occurrences, within 24 hours, to ensure that you have the best information available. At that time, we will request your permission to come onto the property to attempt to capture and relocate the animals. We also ask that you consider sharing your trapping information with the Service and the NCWRC as it would be very useful to us in our continued efforts to manage the population of red wolves and coyotes and in assisting you with to fulfill your management goals. Lastly, we would welcome an opportunity to discuss ways that we could better assist you in your trapping efforts as we appreciate the financial burden.

I believe that you have demonstrated that private landowners, the State, and the Service can work together in solving many of the canid management challenges in eastern North Carolina. Again, the Service welcomes the opportunity to work with and assist you in addressing matters pertaining to red wolves. If you have any questions, please feel free to contact me at (919) 856-4520, or Art Beyer, Red Wolf Recovery Field Coordinator at (252) 473-1132.

Sincerely,

Pete Benjamin
Field Supervisor

Benjamin, Pete <pete_benjamin@fws.gov>

Quick Question

7 messages

Eversen, Michelle <michelle_eversen@fws.gov> Wed, Feb 18, 2015 at 4:54 PM
To: Arthur Beyer <arthur_beyer@fws.gov>
Cc: Pete Benjamin <Pete_Benjamin@fws.gov>

Working on the power point and have a quick question -

Of the 400+ Removal Requests how many actually resulted in removals and of how many animals - I want to make sure that this response and what it indicates are captured in the presentation for Dan.

Art - I think you gave us some numbers once before but could you send some current summary stats.

As always - I need this ASAP if I am to get it into the presentation.

Thanks,

Michelle
--
Michelle Eversen
ES Program Supervisor
Southeast Region
U.S. Fish and Wildlife Service

1-404-679-4108 (Office and Mobile)

1875 Century Blvd.
Atlanta, GA. 30345

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Benjamin, Pete <pete_benjamin@fws.gov> Wed, Feb 18, 2015 at 6:21 PM
To: Michelle Eversen <michelle_eversen@fws.gov>
Cc: Arthur Beyer <arthur_beyer@fws.gov>

Very few. Art would know for sure.

[Quoted text hidden]

Eversen, Michelle <michelle_eversen@fws.gov> Wed, Feb 18, 2015 at 6:29 PM
To: "Benjamin, Pete" <pete_benjamin@fws.gov>

That is what I want to highlight. I can say very few for now but would like to put in the actual number.
[Quoted text hidden]

Arthur Beyer <arthur_beyer@fws.gov> Wed, Feb 18, 2015 at 7:44 PM
To: "Eversen, Michelle" <michelle_eversen@fws.gov>
Cc: Pete Benjamin <Pete_Benjamin@fws.gov>

Hey Michelle -just saw this at home so will try and dig up the most recent update I had sent to Pete a while back and will send tonight. Is first thing in morning too late if I need to go back through database?

[Quoted text hidden]

Eversen, Michelle <michelle_eversen@fws.gov> Wed, Feb 18, 2015 at 8:05 PM
To: Arthur Beyer <arthur_beyer@fws.gov>
Cc: Pete Benjamin <Pete_Benjamin@fws.gov>

No that will work. I am sending it to Leo tonight but I can add that change tomorrow. Thanks for the response
[Quoted text hidden]

Beyer, Arthur <arthur_beyer@fws.gov> Thu, Feb 19, 2015 at 8:36 AM
To: "Eversen, Michelle" <michelle_eversen@fws.gov>
Cc: Pete Benjamin <Pete_Benjamin@fws.gov>

Michelle,

I looked at all the captures resulting from or on properties where we received removal letters, including those by private trappers or landowners themselves, and there were 5 coyotes captured and 8 wolves. We captured 3 of the coyotes and 4 wolves, the rest were by private trappers/landowners.
[Quoted text hidden]

Eversen, Michelle <michelle_eversen@fws.gov> Thu, Feb 19, 2015 at 9:15 AM
To: "Beyer, Arthur" <arthur_beyer@fws.gov>
Cc: Pete Benjamin <Pete_Benjamin@fws.gov>

Perfect - thanks Art!
[Quoted text hidden]

Procedures for responding to landowner requests to remove

red wolves from private property.

September 2014

In July 2014 the Red Wolf Recovery Program began to receive a large number of requests to remove red wolves from private property throughout the red wolf recovery area. Program staff have extensive experience in working cooperatively with landowners to address concerns and have historically been highly successful resolving issues. Nonetheless, in order to address the large number of requests in an efficient, fair and consistent manner and in accordance with our regulations (50 CFR 17.84) the following procedures have been developed.

1. We will respond to all requests[1] by contacting the landowner directly as expeditiously as possible. Requests that involve known or suspected depredation will be responded to within 48 hours.

2. If the incoming letter contains no contact information or if we receive no reply from the landowner within two weeks of our attempts to contact them, we will consider the matter with respect to that property resolved and so note it in the file.

3. If we are able to make contact with the landowner we will verify where the property is and review our records regarding the history of wolf activity in the area, recent telemetry data, and any information provided by the landowner to determine if wolves are (or are likely to be) using their property.

4. For properties where we do not have evidence of consistent recent wolf presence:
   a) If access to the property is provided, we will conduct ground surveys. Given the large number of incoming requests and staffing limitations property surveys may be prioritized by the location and size of the property and historical use patterns.
      1. If only coyote presence is indicated, or there was no indication of any canid presence, we will close out the request and so notify the landowner in writing.
      2. If enough evidence of wolf use is present, we will plan to begin trapping efforts pending staff availability and weather. We may also issue a letter authorizing the landowner to trap wolves under our current State permit.
   b) If access to the property is not provided, we will notify the landowner that currently available data do not indicate the presence of wolves on their property and advise them we will revisit their request if new information (either our own or that provided by the landowner) indicates that wolves are using their property.

5. For properties where we do have evidence of consistent recent wolf presence:
   a) If access to the property is provided we will plan to begin trapping efforts pending staff availability and weather. We may also issue a letter authorizing the landowner to trap wolves under our current State permit.
   b) If access to the property is not provided we will issue a letter authorizing the landowner to trap wolves under our current State permit.

6. Any wolves captured pursuant to trapping efforts conducted under 4(a)(2), 5(a) or 5(b) will be handled in accordance with our regulations at 50 CFR 17.84 and our current State trapping permit; meaning they will be released on refuge lands as soon as possible.

7. Any coyotes captured pursuant to trapping efforts conducted under 4(a)(2), 5(a) or 5(b) will be handled in accordance with our current State trapping permit.

8. Landowners will be advised of all trapping results on their property. Once it is determined that wolves have been removed from the property the landowner will be provided written notice that the matter is considered resolved.

9. If wolves captured per the above procedures repeatedly return to a landowner's property or if reasonable efforts to capture known wolves per 4(a)(2), 5(a) or 5(b) above are unsuccessful we will notify the landowner that efforts to capture such wolves are deemed abandoned and issue a letter authorizing lethal take of the animal in accordance with 50 CFR 17.84. Landowners will be notified that any such take must also be done in accordance if applicable State law.

[1]Requests that are received from property managers or someone other than the landowner must be verified with the property owner listed in the county property records.

Atlanta, GA 30345
1-404-679-7085 (phone)
1-404-353-6448 (Blackberry)
1-404-679-7081 (fax)
Leopoldo_Miranda@fws.gov

Leopoldo Miranda <leopoldo_miranda@fws.gov>

From:	Leopoldo Miranda <leopoldo_miranda@fws.gov>
Sent:	Tue Sep 30 2014 15:29:25 GMT-0600 (MDT)
To:	Arthur Beyer <arthur_beyer@fws.gov>
Subject:	Re: Coyote? Wolf? Caught on my Farm

Let's hold the animal as you suggest. The rule says that but it also says that we could/should keep the animal in captivity if we have issues with its behavior or something like that. The main goal is to have those animals in a safe situation. If their behavior would take them back to a place where they are not wanted, I would say to keep it in captivity until we find an alternative.....

Leopoldo Miranda
Assistant Regional Director - ES
Southeastern US, Puerto Rico & US Virgin Islands
404-679-7085 (Off)
404-353-6448 (Mobile)

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

Sent from my iPad

On Sep 30, 2014, at 1:49 PM, Arthur Beyer <arthur_beyer@fws.gov> wrote:

> Sorry catching up late but stuck in Hyde county today and can't get much service. This was a female wolf pup born in April on property to the north, genetics were done at that time and also transpondered. Though the rule has us releasing immediately on refuge, I'd prefer we hold it for some time, maybe a month or so.
> They are typically too small for a collar at this age so we would likely use an implant transmitter.
>
> I do need to follow up with State folks and can ask Gordon who best to contact unless you have a recommendation. Should be back in ofc in a few hours if

Harrison, Rebecca <rebecca_harrison@fws.gov>

(no subject)

Beyer, Arthur <arthur_beyer@fws.gov> Tue, Oct 28, 2014 at 10:11 AM
To: Pete Benjamin <pete_benjamin@fws.gov>
Cc: Rebecca Harrison <rebecca_harrison@fws.gov>

Hey Pete,

I need some guidance on how we deal with wolves captured in response to landowner requests for their removal. We have a few wild wolves captured recently being held in pens that I need to determine release dates for, if at all. The last time we talked was when you and RO folks were here in Manteo and it came up that we need to determine a strategy for these animal. There are a couple of scenarios that may be considered and other conditions as well that might influence a decision including the following:

In one current case we have the female pup captured by a local trapper for [redacted] after receiving authorization from us to trap properties Mr. [redacted] manages. This authorization was good for 30 days which expired last week, and the trapper is no longer trapping. From what we understand, those efforts were minimal as the trapper was not comfortable using the larger traps provided by Mr. [redacted], and he was not receiving the compensation from Mr. [redacted] originally agreed upon. In addition:

- As a wolf pup, based on past releases of pups being held this long, we are at a point where each day we hold the animal the less likely it is to be accepted back into the social structure of the pack.
- The property it was captured from is a much smaller portion of this pack's territory, and there is a good chance it would not return to where it was captured but remain to the north with the rest of that pack on property it is allowed
- As we approach a 2-month period we risk having a wolf that is too tolerant of people to be released given the current holding conditions we have in place. This is likely one reason we removed an older wolf by gunshot last month due to it's tolerance of people, likely caused from us holding that wolf captive for an extended period of time to treat for tick-borne diseases

In light of these conditions, I would like to release this wolf as soon as possible, to avoid creating human tolerance and so it is accepted back into the pack structure. Although too small for a radio collar at this point, it has already received an abdominal transmitter in case it were to escape from the holding pen.

In another scenario, we are currently trapping property in response to a landowner request for the removal of wolves, and it is more likely that as wolves are captured and released they could return to areas they are not wanted. This pack uses a large area that does include property where it is allowed to remain, but also encompasses a few landowners that have expressed wanting wolves removed.

- It is possible that we can hold older wolves (yearlings, adults) from this pack for longer periods of time to avoid directly returning upon release, though this would be more effective with pens appropriate for this type of scenario (larger, more secluded) and a change in our handling protocol.
- If possible we can attempt to pair yearling wolves with non-related ones in order to create a new pair on a refuge, which would aid in keeping the wolves off properties they are not wanted, but also help us create wolf groups on refuges where we have lost them
- Wolves from this particular pack range would not likely be used in the captive breeding program due to genetics.

Given the likelihood that wolves in this scenario would not be incorporated into the captive breeding program, I would like to incorporate a strategy where such wolves could be released but given a 2 or 3-strike rule of removal should they return to the original capture location they were requested to be removed, at which time a letter of take be considered.

I hope this information helps and please let me know if I can provide clarification, as any assistance or guidance would be greatly appreciated.

Art

Harrison, Rebecca <rebecca_harrison@fws.gov>

(no subject)

Beyer, Arthur <arthur_beyer@fws.gov> Fri, Oct 31, 2014 at 9:57 AM
To: "Benjamin, Pete" <pete_benjamin@fws.gov>
Cc: Rebecca Harrison <rebecca_harrison@fws.gov>

I don't think I would at this point. He has only captured 2 animals one of which was not from that area. I would think we would need to see animals going back and meeting that 2 or 3 strike scenario as was the case with [redacted]. In addition, if local wolves aren't using his property much, we may open the door for him to shoot dispersing wolves such as the one captured yesterday.

[Quoted text hidden]

Harrison, Rebecca <rebecca_harrison@fws.gov>

(no subject)

Beyer, Arthur <arthur_beyer@fws.gov> Thu, Nov 20, 2014 at 12:06 PM
To: Pete Benjamin <pete_benjamin@fws.gov>
Cc: Rebecca Harrison <rebecca_harrison@fws.gov>

Hey Pete,

I didn't know if you were still being asked or directed to issue a letter authorizing take to either [redacted] or [redacted], but if so wanted to share my thoughts on where we are regarding their removal requests.

I attached the latest draft we put together with you on Removal Request Procedures but can't recall if we had another version. Just using those procedures however I don't see us in the scenario at this time of issuing either of these two a letter authorizing take.

Regarding [redacted]:

- We have not determined any wolf presence/use on the property. We have not been given access to the [redacted], and to my knowledge have not been provided any further evidence of wolf presence by [redacted]. Only coyote sign was observed by us during survey of his property in [redacted].
- We lost contact with the radio collar of the the one wolf we were monitoring in the area [redacted], having last heard it 10/21/14. That wolf had been in that area for a number of years now, and the collar was relatively new suggesting it was not a battery-life issue. So in this case, we do not have a wolf we could identify in authorizing take for.
- To my knowledge there has been no effort to remove any wolves, so I don't believe we could demonstrate any abandonment of such efforts. On this point, I am still unclear at what point abandonment takes place, particularly if access is never provided or removed during our efforts to capture wolves. Based on previous discussions with the Solicitor, it is our understanding that foreclosure to access does not equate to abandonment of effort, and there is no required response period within the regulations. I believe this was reiterated by Jack Arnold and Aaron Valenta in an email from David last year (attached).
- I have one additional point of concern regarding issuing a letter in this case. [redacted]. Any use by a large canid of this property would be a very limited portion of it's territory, unless it was denning or possibly visiting a bait pile enough to justify regarding this as consistent use. In light of the current evaluation and possibly pulling back to refuge lands, [redacted]

Regarding [redacted]:

- Although they have trapped under our authorization, they have only captured two wolves on property [redacted] manages. One was a wolf pup that was captured 9/28/14, and released on refuge lands on 11/7/14. As of this week that pup has moved back to the eastern portion of it's home range and was heard northeast of any properties that [redacted] manages. At this point, this wolf has not returned repeatedly to the property it was captured on, thus going by the procedure we outline we would not provide a letter of take at this time.
- The second wolf was a dispersing female from a pack in Hyde County that was captured 10/30/14, and also released on refuge lands on 11/7/14. It has since returned to it's natal home range in Hyde Co. Again, this wolf has not returned to properties managed by [redacted].
- We have not been able to discern the level of effort that has gone into trapping by [redacted] Discussions with [redacted] by the field crew who know him on a personal basis suggest it has been minimal at best.

Becky had mentioned the idea of a protocol or sop that addresses issuing letters of take, but as this is a form of wolf removal I think we may have that wrapped up in the removal request procedures. There may be some specific points to address but that may just be amending those procedures.

Just wanted to run this by you and see if there was anything else you wanted us to put together.

Thanks
art

---

2 attachments

2014.09.09.Removal Request Procedures.docx
17K

20131220_Mail - Mr_EXEMPTION 5.pdf
107K

FOR IMMEDIATE RELEASE
June 30, 2015 Contact: Tom MacKenzie, 404-679-7291
tom_macKenzie@fws.gov

Service Halts Red Wolf Reintroductions Pending Examination of Recovery Program

- Will manage animals already in the wild under existing rules for
- non-essential, experimental population -

The U.S. Fish and Wildlife Service announced today it will suspend its reintroductions of red wolf into the wild while it gathers additional science and research into the feasibility of recovery for the species under the Endangered Species Act (ESA). The Service intends to complete its review by the end of 2015. Existing red wolves located in five eastern North Carolina counties will be managed in accordance with rules put in place in 1995 to govern this population, designated "non-essential, experimental" under the ESA.

This decision was made after a comprehensive evaluation of the population and its role in the overall recovery effort for red wolves by The Wildlife Management Institute in November.

In light of this evaluation (available at http://www.fws.gov/redwolf/evaluation.html) and the substantial management history of the population in Beaufort, Dare, Hyde, Tyrrell, and Washington counties, the Service found more work is needed to determine both lessons learned and the role of these wolves in the overall recovery effort.

"The Wildlife Management Institute's review identified a number of areas where we have been successful, a number of areas that need improvement, and highlighted a number of uncertainties and serious challenges for the ultimate recovery of the red wolf," said Cindy Dohner, the Service's Southeast Regional Director. "As we've said before, we recognize too that there were misunderstandings, particularly about the non-essential, experimental population, and we did not always meet the expectations we set. Now, we need to do a thorough and deliberate evaluation of the red wolf recovery program.

"There will likely be some who will suggest we are walking away from recovery efforts for the red wolf and simultaneously there will be others who might say we're holding on too tight," she added. "We have a responsibility under the ESA to provide good management and shepherd the conservation and recovery of this species to the best of our ability. What we are announcing today holds true to those responsibilities and the expectations of our citizens and partners."

As part of the process, the Service is exploring the idea of establishing a forum for stakeholder involvement.

"These actions are the next steps in our commitment to get the science right, rebuild trust with our neighbors in those communities, our state partners and many stakeholders as we address issues regarding the overall recovery of the red wolf," Dohner added.

For more information on the red wolf program, please visit: http://www.fws.gov/redwolf/index.html.

The ESA provides a critical safety net for fish, wildlife and plants and has prevented the extinction of hundreds of imperiled species, as well as promoting the recovery of many others. The Service is actively engaged with conservation partners and the public in the search for improved and innovative ways to conserve and recover imperiled species.

The U.S. Fish and Wildlife Service works with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. For more information, visit **www.fws.gov**, *or connect with us through any of these social media channels: Facebook, Twitter, Flickr, YouTube.*

-FWS-

Resolution Requesting that the United States Fish and Wildlife Service Declare the Red Wolf (*Canis rufus*) Extinct in the Wild and Terminate the Red Wolf Reintroduction Program in Beaufort, Dare, Hyde, Tyrrell, and Washington Counties, North Carolina

Whereas, the purposes of the Endangered Species Act (ESA) are "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved [and] to provide a program for the conservation of such endangered species and threatened species"; and

Whereas, these species of fish, wildlife, and plants conserved under the ESA are to be of "esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people"; and

Whereas, red wolves (*Canus rufus*) were listed as endangered in 1967 by the United States Fish and Wildlife Service (USFWS) under the Endangered Species Preservation Act of 1966 resulting in initiation of intensive recovery efforts; and

Whereas, red wolves were believed by the USFWS to be extinct in the wild by 1980; and

Whereas, red wolves produced in captivity from 14 founders originating from 400 wild canids captured from 1973 through 1980 were first released onto the Albemarle Peninsula in the Alligator River National Wildlife Refuge (ARNWR) in 1987; and

Whereas, USFWS designated red wolves on federal lands in the ARNWR and Dare County Bombing Range as a non-essential experimental population, expanding that designation to include Pocosin Lakes National Wildlife Refuge in 1995, a cumulative total of 310,000 acres; and

Whereas, the red wolf recovery area, as currently designated, includes Beaufort, Dare, Hyde, Tyrrell, and Washington counties; and

Whereas, a majority of the lands in those counties are held in private ownership; and

Whereas, the red wolf recovery program is predicated upon the USFWS's stated goal in 1986, 1991, and 1995 rules for establishing a self-sustaining population managed on federal lands, and under 10(j) rules minimizing negative impacts of red wolves on private lands; and

Whereas, since initiation of the restoration project active management of habitats to benefit red wolves on federal lands has been minimal, resulting in predominant use of private lands by wolves to meet to annual life requisites, a scenario inconsistent with stated USFWS goals; and

Whereas, climate change models indicate that much of the current recovery area will ultimately be inundated by sea level rise; and

Whereas, predominate use of private lands by red wolves continues to increasingly impact land-use options for these landowners, a scenario also inconsistent with USFWS goals and rules; and

Whereas, the USFWS has been unable to fulfill its obligations under federal rules to resolve these conflicts; and

Whereas, coyote distribution and density has continued to increase across the recovery area, resulting in increased hybridization and introgression among red wolves and coyotes; and

Whereas, purity of the red wolf genome is questionable and has been debated since initiation of restoration efforts; and

Whereas, increases in coyote populations combined with coyote/red wolf hybridization and introgression has eliminated a taxonomically unique red wolf; and

Whereas, on October 14, 2014, the USFWS released A Comprehensive Review and Evaluation of the Red Wolf (Canis Rufus) Recovery Program (Programmatic Review); and

Whereas, the Programmatic Review includes conclusions that the Alligator River, Pocosin, Mattamuskeet, and Swan Quarter National Wildlife Refuges and Dare County Bombing Range within the restoration area cannot be managed or restored in a manner that would provide sufficient habitat for the current population of red wolves.

Now, therefore, be it resolved, that because red wolf restoration is no longer consistent with the goals of the ESA, and because current and future conditions make restoration and management of a self-sustaining population of red wolves on federal lands both taxonomically and operationally impossible, the North Carolina Wildlife Resources Commission hereby requests that the USFWS:

- declare in federal rules that the red wolf is extinct in the wild in North Carolina,
- terminate the Red Wolf Reintroduction Program for free-ranging red wolves in North Carolina,
- repeal all federal rules describing, delineating, and designating conditions for red wolf restoration in North Carolina,
- designate all wild canids other than foxes on the Albemarle Peninsula as coyotes or coyote-hybrids,
- designate that no federal-trust canids exist on the Albemarle Peninsula, and
- designate that all wild canids on the Albemarle Peninsula are state-trust resources under the jurisdiction of the North Carolina Wildlife Resources Commission.

Approved, this the 29th day of January, 2015, in an official meeting by the North Carolina Wildlife Resources Commission.

Jim Cogdell, Chairman

Gordon Myers, Executive Director

Resolution Requesting that the United States Fish and Wildlife Service Remove Red Wolves Released Onto Private Lands in the Red Wolf Recovery Area Located in Beaufort, Dare, Hyde, Tyrrell, and Washington Counties, North Carolina

Whereas, the federal Red Wolf Recovery Plan institutes the clear goal that the non-essential experimental population (NEP) of red wolves on the Albemarle Peninsula of North Carolina should be managed on "federal lands"; and

Whereas, as evidenced by research, red wolves are more likely to utilize agricultural fields than all other habitat types combined; and

Whereas, agricultural fields are primarily found on privately owned lands; and

Whereas, the well documented persistence of red wolves on private lands is not in harmony with achieving the explicit goal set forth in the Red Wolf Recovery Plan that the red wolf NEP should be managed on "federal lands"; and

Whereas, the USFWS also released at least 64 captive-reared wolves on privately owned land; and

Whereas, this release of wolves on private lands could only inhibit the USFWS' ability to meet its explicit requirement that the red wolf NEP should be managed on "federal lands"; and

Whereas, this release of wolves on private lands was an unauthorized activity under federal rules;

Now, therefore be it resolved, that because the release of 64 wolves onto private lands is inconsistent with the explicit goal of the Red Wolf Recovery Plan that the red wolf NEP should be managed on "federal lands" and because that release of wolves on private lands was an unauthorized activity under federal rules, the North Carolina Wildlife Resources Commission hereby requests that the USFWS immediately capture and remove those wolves, including any offspring arising solely therefrom.

Approved, this the 29th day of January 2015, in an official meeting by the North Carolina Wildlife Resources Commission.

Jim Cogdell, Chairman

Gordon Myers, Executive Director

INFORMATION MEMORANDUM FOR THE DIRECTOR

DATE: February 24, 2015

FROM: Cynthia K. Dohner, Regional Director, Southeast Region

SUBJECT: Proposed Alternative Next Steps for the Non-Essential Experimental Population of Red Wolves in Eastern North Carolina

The purpose of this informational memorandum is to summarize the key findings from the Red Wolf Program evaluation in eastern North Carolina and to present the alternative approaches for next steps with the non-essential experimental population (NEP) of Red Wolves.

BACKGROUND

In 2012, the Red Wolf Coalition, Defenders of Wildlife, and Animal Welfare Institute filed a lawsuit against the North Carolina Wildlife Resources Commission (NCWRC), alleging they violated the North Carolina Administrative Procedure Act when it adopted a temporary rule to allow coyote hunting at night with artificial lights on public and private lands throughout the state, placing the Red Wolf in harm's way due to similarity of appearance. In 2014, the court issued an injunction on all coyote hunting in the five counties covered by the Red Wolf NEP. The result was an outcry from private landowners that the U.S. Fish and Wildlife Service (Service) is not properly managing the Red Wolf program, particularly on private lands, and that the wolves were in fact only coyote hybrids wasting taxpayer money. This situation has put the Red Wolf recovery program in the spotlight of public opinion. As a result, the NCWRC issued two resolutions against the Red Wolf reintroduction program alleging that the Service did not comply with its 10(j) rule. The first resolution asked the Service to remove wolves (i.e., 64 animals released from captivity onto private lands and their offspring) from private lands and the second resolution requested the termination of the program in North Carolina.

In response, we initiated our own internal examination into the 10(j) rules governing the existing NEP and the alignment of our management practices. It was evident that the Service did not always follow the 10(j) rule and that our collaboration with the State regarding the NEP had been lacking. In response, the Service expanded its partnership with the NCWRC at all levels (from field staff to agency Directors), the program management was immediately changed from Refuges to Ecological Services (ES); the program coordinator was reassigned; no more wolves have been released onto private lands from captivity; the ES ARD issued the first ever take permit to a private landowner; and a new agreement was developed with NCWRC forming the Albemarle Peninsula Canid Conservation Collaborative. We also asked the Wildlife Management Institute (WMI) to conduct an independent evaluation of the NEP to inform the Service about next steps with the NEP to address the concerns of the State, landowners, and concerned citizens. WMI completed and published their report in November, 2014. Key WMI report findings, combined with additional information and an evaluation of similar 10(j) species populations were all used to develop the alternatives and next steps for the Red Wolf NEP.

DISCUSSION

After examining all of the information in the WMI report; other NEPs; and new information after the WMI report was published, the challenges and consequent recommendations were broken into two groups: those that affect the species recovery and require a response regardless of the fate of the NEP, and those that influence the immediate decision alternatives for the NEP.

Factors and Recommendations Affecting the Recovery Program as a Whole:
The WMI report highlighted many of the challenges facing the species recovery program as a whole which the Service must resolve to inform all future Red Wolf recovery program decisions. Although most of these challenges cannot be fully addressed before determining the fate of the NEP in eastern North Carolina, it is important to identify them as they influence the immediate decision about the NEP. First, WMI highlighted the continued disagreement in the scientific community over the taxonomy of the Red Wolf. This is an area that has always been a challenge to the program and should be revisited to ensure that future decisions regarding the Red Wolf continue to be guided by the best science. Similarly, WMI recognized the use of sterilized animals (coyotes or coyote wolf hybrids) to prevent hybridization within a pack until it is displaced by a Red Wolf, also known as the "placeholder strategy", is a valid conceptual technique to reduce introgression of coyote genes into the Red Wolf population. However, there remain questions about efficiency and duration over which this level of management would be necessary. Further, WMI found hybridization remains the largest threat to Red Wolf recovery and is exasperated by the loss of breeders during the breeding season, particularly due to human-induced mortality, such as gunshot wounds, trapping and vehicle strikes. Therefore, all future recovery efforts must address the impact of hybridization with coyotes and loss of key individuals due to human-induced mortality.

WMI also correctly surmised that the existing Refuge and other federal lands alone (~330,000 acres) are inadequate to support population recovery goals for the NEP as defined within the current 10(j) rule. This fact is only exasperated by the predicted loss of available habitat and/or land mass in the NEP area to sea level rise. These findings are well documented and further emphasize the need to revisit the current 10(j) rule and recovery plan goals for this and other future NEPs accordingly. These findings also illuminate the essential role of private lands to any alternative that continues the NEP. Given the lack of large tracts of public lands within the historic range of the Red Wolf, this will likely apply to all future NEPs as well. Ultimately, we must revise the Red Wolf Recovery Plan accordingly and identify alternative sites for additional NEPs. Lastly, while the WMI report did include an evaluation of public opinion towards the recovery effort, the evaluation was not designed to provide statistically valid conclusions but rather to gauge opinions and concerns. It was clear from the survey that there is substantial and differing interest in both the local community and the public at large in all aspects of the Red Wolf. We will have to complete additional studies to reach conclusions about the human dimension capable of informing management decisions. All of the above must be addressed by the Service as part of future recovery efforts for the Red Wolf regardless of the fate of the NEP in North Carolina.

NEP Alternatives:
Each of the alternatives for the Red Wolf NEP has pros and cons on the continued efforts to conserve the species; have significant ramifications for program management; will require environmental compliance (e.g., Sec. 7, NEPA); and all have different degrees of legal vulnerability. Also, regardless of the alternative selected, the Service will need to determine if the conclusions in the Intra-Service Section 7 consultation, when we first established the 10(j) rule in 1986, are still valid. For example, we will need to re-evaluate the conclusion that "the species reproductive vigor in captivity is secured and its survival is biologically assured" and the ultimate determination that the removal of eight to 12 animals from the captive population and introducing them into the NEP area is not likely to jeopardize the existence of the species.

Pending additional research into the scientific uncertainty (e.g., viability, taxonomy, habitat requirements, predator prey interactions) of the Red Wolf, the limitations to success for the NEP comes down to resource allocation; human dimensions; and what is in the best interest for the conservation of the Red Wolf. The two broad alternatives are <u>to continue</u> the reintroduction effort in Eastern Northern Carolina or <u>to terminate it</u>. Each can be accomplished in multiple ways with differing pros and cons and each will take between one to five years to implement. However, regardless of the decision, the Service must implement a first step in this process because, as described in the WMI report, the Service "did not always comply with the rules established for the reintroduction program." Therefore, the first step is to bring the existing Red Wolf Reintroduction Program in eastern North Carolina back in compliance with its governing 10(j) rule as we work through all the scientific and legal policy and regulatory compliance issues associated with any of the proposed alternatives described below.

Regardless of the final decision on Red Wolf management, the current situation with this species provides an opportunity to evaluate our implementation of a Red Wolf recovery program in contemporary landscapes and complex human dimensions.

<u>First step in the process – Bring the reintroduction program into compliance</u>:
This first step is an interim phase that requires that the Service manage and operate the reintroduction program from federal lands; all landowner removal requests be honored; and, if recapture efforts are not successful, that we issue "take" authorizations to those landowners as described in our 10(j) rule.

Some important "pros" with this first step are that it is immediately actionable; and it will require constant and efficient landowner outreach. It will show immediate management action to address the findings outlined in the WMI report and the concerns expressed by the NCWRC. These changes include, but are not limited to, management of wolf populations only from federal lands, a significant amount of wolves, currently on private lands, will be removed from the wild. The Service will also need to answer some fundamental questions like "is it possible to have a viable self-sustaining population in the NEP area?" Implementing this first step will also allow for the opportunity to work with and learn from private landowners in the development of conservation tools and incentives essential to the successful establishment any future NEP.

It is very important to point out that all alternatives (below), including this first step (above), require environmental compliance process. Depending on the alternative chosen, environmental

compliance will consist of a Section 7 consultation for those alternatives not requiring a rule change (i.e., first step and alternative 1a) to a full NEPA process in case a rule change is needed (i.e., alternatives 1b and 2).

Alternative 1 – Terminate the Reintroduction Effort in Eastern North Carolina:

There are two approaches to terminating the reintroduction effort. The first is to terminate the reintroduction without rule making, leaving the NEP in place but terminating recovery efforts and removing the remaining animals from the wild (Alternative 1a). The second approach is to go through a rule making process to terminate the NEP and its associated 10(j) rule (Alternative 1b).

Alternative 1a would be similar to the termination of the Great Smokey Mountains National Park Red Wolf reintroduction effort in 1998. In this case, a Federal Register notice was published and the animals were removed from the wild. However, the NEP and the associated 10(j) rule remains in place. If this alternative is selected as our final decision, the Service will develop documentation for the administrative record that clearly outlines the rationale for the decision and do a Section 7 consultation on the action. This approach would be consistent with similar actions with other 10(j) populations. The benefit of this alternative is that no rule change is required which means that our response to the WMI report and concerns from the State and landowners would be more immediate and the removal of the animals from the wild limits any further management liability. In addition, there are currently between 75-100 red wolves in the NEP area. If most of these animals are placed in captivity, it will advance meeting one of our recovery goals of having 330 animals in captivity to be used in future reintroduction efforts (we currently have approximately 210 wolves in captivity, representing 12 of the 14 founders). The main con for this alternative is that all of the remaining wolves on the landscape would need to be trapped and removed from the wild as it occurred in the 1970s before the Service declared the species "extinct in the wild" in 1980. Currently, infrastructure to maintain these animals in captivity is very limited. Additional resources will be needed to expand this capacity. We estimate that implementing this alternative would take between 12 and 18 months.

The other approach is to terminate the NEP through rule making (Alternative 1b). Terminating the NEP requires that we rescind the 10(j) rule through rule making and public comment. The one additional pro of this alternative, as compared to 1a, is that it offers a definitive resolution and a final agency action. As a final agency action, either an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) would need to be developed which would require several years of work. The obvious additional con to this alternative is that it will take more time than alternative 1a. We estimate that implementing this alternative would take between three to five years.

Both alternatives 1a and 1b would benefit continued conservation efforts for the species in that all recovery efforts would be focused on the captive population and addressing the factors identified above affecting the recovery program as a whole rather than managing the NEP. Terminating the NEP could potentially allow resources to be redirected in the future to other species in need of limited recovery dollars. However, the current NEP offers the only wild population of red wolves to answer the many remaining questions identified in the recovery plan

and through the program evaluation. At this time, it is unlikely that other States would be willing to accept a new Red Wolf population if the Service cannot address these issues.

Alternative 2- Maintain the NEP:

This alternative is to maintain the NEP but change the 10(j) rule to address the questions raised regarding the habitat realities on our refuges and other federal lands now and into the future (e.g., sea level rise, lack of adequate prey base); removing the requirement that the population goals be met solely on federal lands; and maximizing private landowner incentives and exemptions. This alternative requires a 10(j) rule change, NEPA, and other environmental compliance. We estimate that implementing this alternative would take a minimum of three to five years. The "pros" and "cons" of this alternative include showing demonstrable management changes addressing the WMI findings (as they relate to the current 10(j) rule) and the additional downside of taking the most time and requiring the most resources of all the alternatives.

NEXT STEPS

- Implement the interim "First Step" described above.
- Develop a robust outreach/communications strategy.
- Expand captive population facilities.
- Revise recovery plan and explore new areas for potential new NEPs.
- If possible, continue to support an interagency agreement with NCWRC and associated research components (e.g., population viability, hybridization, predator-prey, human dimensions).

BISON CONNECT

Beyer, Arthur <arthur_beyer@fws.gov>

Re: Trapped Canids

1 message

Miranda, Leopoldo <leopoldo_miranda@fws.gov> Mon, Feb 9, 2015 at 10:32 AM
To: [redacted]
Cc: "Gordon S. Myers" <gordon.myers@ncwildlife.org>, Pete Benjamin <pete_benjamin@fws.gov>, Michelle Eversen <michelle_eversen@fws.gov>, Arthur Beyer <arthur_beyer@fws.gov>

[redacted]

Sorry that my earlier reply was kind of short. To give you some more detailed answers to your points. This animal, as well as the other will not be released back into the wild at least until we make a final determination on the future of this population.

we can provide ID information on who these animals captured on your property. I will also ask my staff to facilitate providing a blood sample. However, I personally don't know how this may work so I will ask Art to help me with that.

No coyotes (collared or uncollared will leave your farm. We only ask to be able to retrieve the collar if one of the placeholder animals is captured.

Art is trying to call to coordinate his visit. Maybe you already spoke to him but let me know if I can be of any help with that.

Thanks [redacted] for letting us know so quickly. I am glad that you are giving us the opportunity to retrieve those wolves even when you have the authorization to take a wolf. Even when our agency and you may be in disagreement we both look to protect these individuals. In my opinion, speaks volumes on how we can work with landowners.

Thanks again and call us any time.

Leo

Leopoldo "Leo" Miranda
U.S. Fish and Wildlife Service
Assistant Regional Director, Ecological Services
Southeast U.S., Puerto Rico and U.S. Virgin Islands
1875 Century Boulevard
Atlanta, GA 30345
1-404-679-7085 (phone)
1-404-679-7081 (fax)
Leopoldo_Miranda@fws.gov

On Sun, Feb 8, 2015 at 7:33 PM, [redacted] wrote:

> Leo,

Today we caught a very large male wolf with a new collar on it. My request is the same as it was with the large female wolf we caught on Friday.

- Written confirmation from USFWS that this wolf will never be released in the State of NC.

- The wolf ID number, so NCWRC can confirm it is not in the wild in NC.

- DNA sample from this wolf.

- Determine if this was an unauthorized released wolf.

For the record, USFWS entered my farm yesterday through my locked gate with no permission. Again, for the record, USFWS personnel are not allowed on my farm without my permission.

Please let me know if we can move forward with this wolf in the requested manner. I still need the wolf ID number for the female wolf caught on Friday.

Thanks,
[redacted]

-----Original Message-----
From: [redacted]
To: leopoldo_miranda <leopoldo_miranda@fws.gov>
Cc: gordon.myers <gordon.myers@ncwildlife.org>
Sent: Sat, Feb 7, 2015 2:52 pm
Subject: Re: Trapped Canids

Thank you Leo.

-----Original Message-----
From: Leopoldo Miranda <leopoldo_miranda@fws.gov>
To: [redacted]>
Cc: gordon.myers <gordon.myers@ncwildlife.org>
Sent: Sat, Feb 7, 2015 2:49 pm
Subject: Re: Trapped Canids

[redacted],

No worries. As you are aware, Chris was able to come by and found that the collared animal turned out to be a 10 year old female who we lost track of last year. That's a really old animal. From Chris's description it sounds as if she has mange as well. She will be treated and put in a pen at our facilities in Sandy Ridge and not released. The other animal was a coyote. Chris left it there.

Any questions just let me know.

Leo

Leopoldo Miranda
Assistant Regional Director - ES
Southeastern US, Puerto Rico & US Virgin Islands
404-679-7085

Sent from my iPad

On Feb 7, 2015, at 7:18 AM, [redacted] wrote:

Leo,

I do not mean my emails to be directed at you personally, but rather USFWS. Let me help you here with my request please.

1. The attached USFWS map clearly shows that these red wolves were never native to the State of NC. Accordingly, USFWS has no authority to release them here anyway. In fact, USFWS is likely in violation of several wildlife laws for introducing a non native invasive species to our State.

2. USFWS has grossly exceeded their stated carrying capacity for their Federal lands and release on private lands is not authorized, so how can USFWS possibly re-release the wolf? See the USFWS 1986 and 1995 special rules for the stated red wolf carrying capacities.

3. USFWS has for 28 years proven they have no intention whatsoever of restricting these wolves to their refuges as promised in the above rules. Why should I live trap and return a wolf that USFWS will allow to come straight back?

4. Have Art bring a wand and the "canid" book and lets determine if this is one of the 64 unauthorized released wolves or their offspring. If it is an unauthorized wolf, I will want to know the individuals that released the unauthorized wolf onto private land in

NC.

5. Will this exchange today once again prove that USFWS's failure to abide by their rules and keep their wolves on Federal land is the largest factor in red wolf deaths in NC?

Thanks,
[redacted]

-----Original Message-----
From: [redacted]
To: leopoldo_miranda <leopoldo_miranda@fws.gov>
Cc: gordon.myers <gordon.myers@ncwildlife.org>
Sent: Sat, Feb 7, 2015 5:05 am
Subject: Re: Trapped Canids

Leo,

This does not work. Your wolves have destroyed the wildlife on my farm. In addition, this will be the second year in a row, I have given up using my farm to train my field trial dogs because I am live trapping **your wolves** on it. This is a big deal to me. I even had to cancel a horseback trail ride next week for several ladies and children on this farm. I did not buy this farm for your red wolf program.

USFWS promised their wolves would stay on their land and would not negatively impact legal activities on private land. What a bold faced lie.

The NCWRC took a major stand last week. I will wholeheartedly support them as they have me. The revolving door for your wolves has closed.

If I must control canids on my farm using lethal means, I will. There will likely be incidental kills of wolves, which I have strived to avoid. There will likely be legal and permitted kills of wolves on my farm, again which I have strived to avoid. The choice is yours.

I do not believe anyone has ever gone to the lengths that I have in order to save your wolves and their farm at the same time.

It has often been said that because USFWS has not followed their

own rules in any way shape or form, they are creating five counties full of criminals. That makes me mad.

Now, I need a commitment from you that red wolves trapped on my farm will **never** be released in NC again.

Thanks,
[redacted]

-----Original Message-----
From: Leopoldo Miranda <leopoldo_miranda@fws.gov>
To: [redacted]
Cc: gordon.myers <gordon.myers@ncwildlife.org>; Pete Benjamin <pete_benjamin@fws.gov>
Sent: Sat, Feb 7, 2015 12:56 am
Subject: Re: Trapped Canids

Dear [redacted]

Thanks for letting us know that there is at least one potential red wolf trapped at your property. I just sent a notification to my staff to contact you on Saturday to coordinate next steps. If it is a red wolf, we will keep it in captivity at least until we make a decision on the future of the program in eastern NC. If it needs to be released, it will not be at least until after that decision is made.

Thank you again for letting us know quickly that you have trapped a potential red wolf. I really appreciate it.

Let me know if you have any questions.

Leo

Leopoldo Miranda
Assistant Regional Director - ES
Southeastern US, Puerto Rico & US Virgin Islands
404-679-7085

Sent from my iPad

On Feb 6, 2015, at 8:49 PM, [redacted] wrote:

> Leo,
>
> We just started trapping my farm and today we caught 2 canines. One appears to be an old collared female and the other a young uncollared male.

Last year I spent a lot of time and money trapping and returning USFWS wolves to you rather than legally killing them in accordance with my take permit. I was promised the wolves would not be released where they would return to my farm. You and I both confirmed this absolutely did not happen. Your biologists chose not abide by our agreement.

I do not intend for this to occur again.

In light of all that has been uncovered about the red wolf program and in keeping with the recent resolutions passed by the NCWRC, I need written confirmation that if any of my trapped canids are considered to be red wolves by USFWS, they will never be released again in the state of North Carolina.

I have cooperated with USFWS and tried in earnest to use my "take" permit via nonlethal means, but the revolving door on my farm is now closed.

Please issue a letter in writing that any red wolves that I live trap and return to USFWS will never be released back into the state of NC. I request the animal ID number and a DNA sample for any animal taken from my farm. I further request to be kept informed of the disposition of these animals. No coyotes, collared or otherwise, will be allowed to leave my farm.

Thanks,
[redacted]

<IMG_0809.JPG>

<IMG_0819.PNG>

Harrison, Rebecca <rebecca_harrison@fws.gov>

Just got another note from [redacted] They have another collared animal.

Beyer, Arthur <arthur_beyer@fws.gov> Mon, Feb 9, 2015 at 4:33 PM
To: "Miranda, Leopoldo" <leopoldo_miranda@fws.gov>
Cc: Pete Benjamin <pete_benjamin@fws.gov>, Rebecca Harrison <rebecca_harrison@fws.gov>, Jack Arnold <jack_arnold@fws.gov>, Michelle Eversen <michelle_eversen@fws.gov>

Hi Leo,

I met with [redacted] on his property today. The collared wolf just captured was male 11737, the resident male for that area that was captured there last year. I sent [redacted] a text at his request with the animal id number, and took a blood sample that I will send to him later this week. Both wolves captured on his property are in a pen at sandy ridge and will remain there pending a later decision on their disposition.

[Quoted text hidden]

BISON CONNECT

Beyer, Arthur <arthur_beyer@fws.gov>

(no subject)

1 message

Beyer, Arthur <arthur_beyer@fws.gov> Wed, Mar 18, 2015 at 1:03 PM
To: Pete Benjamin <pete_benjamin@fws.gov>
Cc: Rebecca Harrison <rebecca_harrison@fws.gov>

Hey Pete,

I Wanted to follow up on our discussion last week regarding the release of 2 male wolves captured on [redacted]s property in Tyrrell Co. by his trapper on February 9th and 26th. Both wolves are currently in pens at Sandy Ridge on Alligator River NWR. An older female wolf was also captured but as a reminder was euthanized due to health-related issues. The question we have is whether these two wolves can be released per our current rule. If we were to release I think it best we release directly from the captive facility on AR. Please let me know any decision or guidance on the issue and I will follow up with the staff.

Thanks,
Art

Benjamin, Pete <pete_benjamin@fws.gov>

Renewal of Take Authorization Request

16 messages

Jett Ferebee <jettferebee@aol.com> Thu, Mar 19, 2015 at 2:41 PM
To: leopoldo_miranda@fws.gov, pete_benjamin@fws.gov
Cc: gordon.myers@ncwildlife.org

Mr. Miranda,

My authorization to take any remaining wolves on my private land expires March 23, 2015. At this time I still have wolves on my farm. I am requesting that my take authorization be renewed.

Over the last 2 years, I have trapped and crated 25 canines of which all wolves were returned to USFWS. I have never had a crate fail.

This year I trapped a large wolf. Art did not want to transfer the animal to his crate and asked if he could take my crate and he left me his USFWS crate. Several days later we caught two more wolves and I had to use the USFWS crate. When Chris arrived to retrieve the animals, one of the wolves had chewed through the USFWS crate and remains on my farm along with others. Attached are pictures.

I appreciate your consideration of my request to renew the permit.

Thank you,
Jett Ferebee

2 attachments

IMG_6268.JPG
353K

FullSizeRender.jpg
81K

Benjamin, Pete <pete_benjamin@fws.gov> Thu, Mar 19, 2015 at 2:54 PM
To: Arthur Beyer <arthur_beyer@fws.gov>

FYI,

Pete Benjamin
Field Supervisor
Raleigh ES Field Office
Office: (919) 856-4520 x 11
Mobile: (919) 816-6408
[Quoted text hidden]

---

2 attachments

IMG_6268.JPG
353K

FullSizeRender.jpg
81K

Beyer, Arthur <arthur_beyer@fws.gov> Thu, Mar 19, 2015 at 3:09 PM
To: "Benjamin, Pete" <pete_benjamin@fws.gov>
Cc: Rebecca Harrison <rebecca_harrison@fws.gov>

Pete,

Here's my take on this:

For starters, I did not request use of his kennel, that was his suggestion that I took so we weren't transferring the wolf from one kennel to the other in the open. From his email dated February 26, 2015: "Your biologists have my permission to enter my property today to retrieve these animals. AsI them to bring some kennel crates as we will need ours or replacements to complete our trapping. One animal is rather large, so plan accordingly." Regardless, this is irrelevant to the request however.

I do not recall how many canids he has "crated", but we have not retrieved 25 wolves from his property. I can look up that number if needed, but his current request would only apply to wolves present at this time, not those captured in the past. This again is irrelevant.

Also, there was NO confirmation that the canid that chewed out of the kennel was a wolf. In fact, the message received from Jett regarding the captures that day (or the previous) were of two canids, one in particular being large, not two (see quote above). Also from Leo in email Feb 26: "I talked to him and he told me that one of them is a very large animal" When Chris Lucash entered the farm to look at both canids, he saw what looked like a smaller coyote running off the road away from where the canids were being held. The one we did retrieve that day from a kennel was a wolf.

At this time we are not tracking any wolves on his property and have no indication that there are any present. My understanding is we would have to issue a permit after attempts to remove wolves have been abandoned. In this case we are not even recognizing or aware of any wolves present, have not made any capture efforts, and have denied similar requests.

If we release either of the two wolves captured from his property that return, that may change things, but that has yet to be determined.
[Quoted text hidden]

Beyer, Arthur <arthur_beyer@fws.gov> Thu, Mar 19, 2015 at 3:11 PM
To: "Benjamin, Pete" <pete_benjamin@fws.gov>
Cc: Rebecca Harrison <rebecca_harrison@fws.gov>

One other thing, he is giving us two photos, we do not know that the canid in the close-up is the same one that chewed out of the kennel. That could simply be the kenneled wolf we retrieved taken in the other kennel.

On Thu, Mar 19, 2015 at 2:54 PM, Benjamin, Pete <pete_benjamin@fws.gov> wrote:
[Quoted text hidden]

Benjamin, Pete <pete_benjamin@fws.gov> Thu, Mar 19, 2015 at 3:22 PM
To: "Beyer, Arthur" <arthur_beyer@fws.gov>
Cc: Rebecca Harrison <rebecca_harrison@fws.gov>

Thanks,

Pete Benjamin
Field Supervisor
Raleigh ES Field Office
Office: (919) 856-4520 x 11
Mobile: (919) 816-6408

[Quoted text hidden]

Leopoldo Miranda <leopoldo_miranda@fws.gov> Thu, Mar 19, 2015 at 5:10 PM
To: Jett Ferebee <jettferebee@aol.com>
Cc: "pete_benjamin@fws.gov" <pete_benjamin@fws.gov>, "gordon.myers@ncwildlife.org" <gordon.myers@ncwildlife.org>

Mr. Ferebee,

Thanks again for your request and for working and coordinating with us every time a wolf is captured on your property. I will work with Mr. Benjamin on the renewal of your authorization. As with the last one, it will come out under his signature.

Thanks again,

Leo

Leopoldo Miranda
Assistant Regional Director - ES
Southeastern US, Puerto Rico & US Virgin Islands
404-679-7085

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

Sent from my iPad
[Quoted text hidden]

<IMG_6268.JPG>

<FullSizeRender.jpg>

Benjamin, Pete <pete_benjamin@fws.gov> Fri, Mar 20, 2015 at 8:48 AM
To: Leopoldo Miranda <leopoldo_miranda@fws.gov>, Arthur Beyer <arthur_beyer@fws.gov>, Rebecca Harrison <rebecca_harrison@fws.gov>, Michelle Eversen <michelle_eversen@fws.gov>

Hello all,

Here is a draft response to Mr. Ferebee. Please provide any comments to me by Monday. I'm sending this draft to Gordon under separate email for his review.

Pete Benjamin
Field Supervisor
Raleigh ES Field Office
Office: (919) 856-4520 x 11
Mobile: (919) 816-6408

[Quoted text hidden]

2015.03.23.Letter.Benjamin to Ferebee.Renewal.docx
19K

Beyer, Arthur <arthur_beyer@fws.gov> Fri, Mar 20, 2015 at 9:19 AM
To: "Benjamin, Pete" <pete_benjamin@fws.gov>
Cc: Rebecca Harrison <rebecca_harrison@fws.gov>

Hey Pete,

One correction I have is that there were 3 wolves captured on his property in February. The two males in pens at sandy ridge, and the older female that was euthanized. Otherwise it looks good to me.

I do want to reiterate that I do not believe we are following our current rules by issuing a take letter when there is no indication or evidence of wolf use

on or adjacent to his property, and thus have not abandoned any efforts at removal, and that lack of access should again not be grounds for abandonment. We have denied requests for take letters under the same conditions, and my understanding as to the reason why the letter was reissued last year was due to the knowledge of wolf 11737 still using his property. This wolf is currently in a pen not having been released post-capture on February 9 of this year. Is it worth mentioning this as reason for reissuing the letter at the end of paragraph 2 in this draft?

Regarding your questions yesterday, male 11737 was born in captivity in 2009 and fostered onto private land in Hyde County upon verbal agreement with the landowner. Male 11649 is wild-born in 2007 in Tyrrell County.

I am still waiting to hear back from Mexican Wolf folks regarding gps collars and will pass that along as soon as I find something out.

[Quoted text hidden]

Benjamin, Pete <pete_benjamin@fws.gov> Wed, Apr 1, 2015 at 3:22 PM
To: Leopoldo Miranda <leopoldo_miranda@fws.gov>, Michelle Eversen <michelle_eversen@fws.gov>

I haven't heard from you guys regarding comments on this draft letter. Any thoughts?

Pete Benjamin
Field Supervisor
Raleigh ES Field Office
Office: (919) 856-4520 x 11
Mobile: (919) 816-6408

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2015.03.23.Letter.Benjamin to Ferebee.Renewal.docx
19K

Miranda, Leopoldo <leopoldo_miranda@fws.gov> Wed, Apr 1, 2015 at 3:26 PM
To: "Benjamin, Pete" <pete_benjamin@fws.gov>
Cc: Michelle Eversen <michelle_eversen@fws.gov>

Sorry about that! I think the only comment I have is with this sentence:

"We also ask that you consider sharing your trapping information with the Service and the NCWRC as it would be very useful to us in our continued efforts to manage the population of red wolves and coyotes and in assisting you with to fulfill your management goals."

I would probably say "continue to share your trapping information"

Leopoldo "Leo" Miranda
U.S. Fish and Wildlife Service
Assistant Regional Director, Ecological Services
Southeast U.S., Puerto Rico and U.S. Virgin Islands
1875 Century Boulevard
Atlanta, GA 30345
1-404-679-7085 (phone)
1-404-679-7081 (fax)
Leopoldo_Miranda@fws.gov

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[Quoted text hidden]

Benjamin, Pete <pete_benjamin@fws.gov> Wed, Apr 1, 2015 at 4:51 PM
To: "Miranda, Leopoldo" <leopoldo_miranda@fws.gov>
Cc: Michelle Eversen <michelle_eversen@fws.gov>

Good.

Pete Benjamin
Field Supervisor
Raleigh ES Field Office
Office: (919) 856-4520 x 11
Mobile: (919) 816-6408

[Quoted text hidden]

Jett Ferebee <jettferebee@aol.com> Tue, Apr 21, 2015 at 1:16 PM
To: Leopoldo Miranda <leopoldo_miranda@fws.gov>
Cc: "pete_benjamin@fws.gov" <pete_benjamin@fws.gov>, "gordon.myers@ncwildlife.org" <gordon.myers@ncwildlife.org>

Mr. Miranda,
Will you please check with Mr. Benjamin regarding this take permit. It has been over a month.
Thanks,
Jett Ferebee

Sent from my iPhone
[Quoted text hidden]

Leopoldo Miranda <leopoldo_miranda@fws.gov> Tue, Apr 21, 2015 at 1:22 PM

To: Pete Benjamin <pete_benjamin@fws.gov>

I think we were ok with the draft you sent us some time ago... Right?

Leopoldo Miranda
Assistant Regional Director - ES
Southeastern US, Puerto Rico & US Virgin Islands
404-679-7085

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Sent from my iPad

Begin forwarded message:

From: Jett Ferebee <jettferebee@aol.com>
Date: April 21, 2015 at 1:16:17 PM EDT
To: Leopoldo Miranda <leopoldo_miranda@fws.gov>
Cc: "pete_benjamin@fws.gov" <pete_benjamin@fws.gov>, "gordon.myers@ncwildlife.org" <gordon.myers@ncwildlife.org>
Subject: Re: Renewal of Take Authorization Request

[Quoted text hidden]

Benjamin, Pete <pete_benjamin@fws.gov> Tue, Apr 21, 2015 at 1:31 PM
To: Jett Ferebee <jettferebee@aol.com>
Cc: Leopoldo Miranda <leopoldo_miranda@fws.gov>, Gordon Myers <gordon.myers@ncwildlife.org>

Hi Mr. Ferebee,

I will have it for you this week or early next. I'm out of the office right now but please call me tomorrow if you would like to discuss. 919-856-4520 x 11.

Pete

[Quoted text hidden]

Leopoldo Miranda <leopoldo_miranda@fws.gov> Tue, Apr 21, 2015 at 1:32 PM
To: "Benjamin, Pete" <pete_benjamin@fws.gov>

Thanks!

Leopoldo Miranda
Assistant Regional Director - ES
Southeastern US, Puerto Rico & US Virgin Islands
404-679-7085

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Sent from my iPad
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Jett Ferebee <jettferebee@aol.com> Tue, Apr 21, 2015 at 1:48 PM
To: "Benjamin, Pete" <pete_benjamin@fws.gov>
Cc: Leopoldo Miranda <leopoldo_miranda@fws.gov>, Gordon Myers <gordon.myers@ncwildlife.org>

Thanks Pete.

Sent from my iPhone

On Apr 21, 2015, at 1:31 PM, Benjamin, Pete <pete_benjamin@fws.gov> wrote:

[Quoted text hidden]

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

April 27, 2015

Mr. John J. Ferebee, Jr.
701 Treybrooke Circle
Greenville, North Carolina 27834

Dear Mr. Ferebee:

We have reviewed your March 19, 2015, request for renewal of the authorization previously provide to you by the U.S. Fish and Wildlife Service (Service) to take a red wolf from your property in Tyrell County, North Carolina. Your request asserted current wolf activity on your property. Three wolves were removed from your property in February of this year. We have no direct evidence of any other wolves in the vicinity of your property.

The Service provided the original authorization to you in a letter dated February 6, 2014. This authorization was provided in accordance with our regulations at 50 C.F.R. 17.84, which state that private landowners may take red wolves found on their property within the Red Wolf Recovery Area after efforts by Service personnel to capture such animals have been abandoned, provided that the Service has approved such actions in writing and all such taking shall be reported to the Service within 24 hours. That authorization was subsequently renewed via a letter from this office dated September 23, 2014.

Prior to issuance of our original authorization you had demonstrated that wolves were consistently using your property despite continued efforts by Service personnel and private trappers hired by you to remove said animals. Your property is adjacent to a National Wildlife Refuge on which red wolves occur. As such, there is no doubt that red wolves have used your property and may occur on your property in the future. As you are aware, Section 9 of the Endangered Species Act and federal regulation pursuant to section 4(d) of the Act prohibit take of endangered and threatened species, respectively, without special exemption such as the protections afforded to you as the landowner for a wide variety of actions you may take to protect your interests, including actions that result in "take" of red wolves. Specifically, you may absolutely take by lethal means wolves that are threatening you, others, livestock or pets on your property or you may take wolves incidental to otherwise lawful activities, such as coyote trapping, so long as those activities have been conducted in accordance with other local, State and Federal regulations. I spell the above out because we believe it describes well the way you have been managing the situation and the cooperative manner in which you have been working with us over the past several months.

Our regulations state that before the Service can provide authorization to a landowner to take red wolves for reasons other than depredation or threats to people and property we must have abandoned our efforts to capture the animal. Over the years many attempts have been made to remove wolves from your property, and while these efforts have often been successful wolves have continued to occupy your land. At this time given our other staffing commitments and lack of access to actively trap on the property we conclude that we are foreclosed from pursuing any animals that may be on your property and in that sense must abandon efforts to capture and relocate the any animals ourselves. Therefore, pursuant to the Service's regulation at 50 C.F.R. 17.84, you and your agents (e.g., co-owners of the property James R. Prewitt and Daniel H. Woody) are granted permission to take a wolf by lethal means as long as the taking is in compliance with any other applicable Federal, State, and local regulations.

This authorization is valid for 180 days from the date of this letter (September 19, 2015). If any wolf is killed on your property, under the terms of this letter, you must notify the Service or the North Carolina Wildlife Resource Commission (NCWRC) within 24 hours of the incident. We encourage you to continue to pursue non-lethal means for taking this animal and use lethal means only as a last resort. If non-lethal means are used (i.e., trapping) the Service will be willing to reimburse you for the costs of trapping that red wolf as long as the activities are performed following Federal, State and local regulations.

Obviously, the Service cannot predict the future use of your property by other red wolves. However, we remain committed to working diligently with you in responding to your needs. To that end, we would welcome opportunities to better inform our collective management efforts. Should the Service or the NCWRC gather data through their telemetry flights or other daily activities indicating that wolves are using portions of your property, we will notify you of such occurrences, within 24 hours, to ensure that you have the best information available. At that time, we will request your permission to come onto the property to attempt to capture and relocate the animals. We also ask that you continue to share your trapping information with the Service and the NCWRC as it would be very useful to us in our continued efforts to manage the population of red wolves and coyotes and in assisting you with to fulfill your management goals. Lastly, we would welcome an opportunity to discuss ways that we could better assist you in your trapping efforts as we appreciate the financial burden.

I believe that you have demonstrated that private landowners, the State, and the Service can work together in solving many of the canid management challenges in eastern North Carolina. Again, the Service welcomes the opportunity to work with and assist you in addressing matters pertaining to red wolves. If you have any questions, please feel free to contact me at (919) 856-4520 extension 11, or Art Beyer, Red Wolf Recovery Field Coordinator at (252) 473-1132 extension 241.

Sincerely,

Pete Benjamin
Field Supervisor